April 1993 Issue #21

Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

in this issue

features

vintage reviews

departments

License Processing Delay Easing

The amateur radio license processing time delay appears to be easing a bit, according to Gordon Girton W6NLG, who administered the Sunnyvale VEC in Northern California. Girton says that he made a check with the FCC's Gettysburg License Processing Facility the week of January 14th and found that the processing time had dropped from the 90-120 days announced by the FCC just before the Christmas holidays to around 60 days in mid-January. W6NLG says that the FCC has processed license applications that it received on November 23rd, and that new licenses were expected to arrive on the West Coast by Monday, January 18.

Girton noted that at Processing Level 1, the FCC has now processed all Form 610 applications that arrived prior to December 2nd. He also says that his VEC operation ships all completed applications to Gettysburg using Federal Express to minimize delay. Since many VE teams and VEC operations use standard US Mail as their delivery carrier, further delays of a few to several days are still possible. *TNX Westlink Report #642, January 28, 1993.*

Amateur Radio Scholarships

The Foundation for Amateur Radio, Inc., a nonprofit organization with headquarters in Washington, DC, plans to administer 47 scholarships for the academic year 1993-1994 to assist licensed radio amateurs. The Foundation, composed of 50 local area amateur radio clubs, fully funds five of these scholarships with the income from grants and from its annual hamfest. The remaining 42 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from $500 to $2,000, with preference given in some cases to residents of specified geographical areas or to the pursuit of certain study programs. Clubs are encouraged to announce these opportunities at their meetings, on their nets, during training classes, and in their club newsletters.

Additional information and an application form can be requested by letter or QSL card, postmarked prior to April 30, 1993, from: FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740. The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary and educational pursuits that advance the purpose of the Amateur Radio Service.

ARRL Files Automatic Control HF Packet Petition

On February 1, 1993, the American Radio Relay League formally requested a final extension of the *Special Temporary Authority* (STA) which currently authorizes certain amateur radio stations to conduct HF digital communications under automatic control. The present STA was first issued July 7, 1987, and has been extended five times. It expired on February 3, 1993.

The League asked, however, that the STA's termination be delayed until the FCC acts on their Petition for Rulemaking (also filed February 1st) proposing permanent rules governing HF data operation under automatic control. The ARRL said they " . . . firmly believe that the petition will be supported by the amateur radio community as a reasonable accommodation for all concerned . . . "

The petition, which has not yet been assigned a Rule Making file number, seeks to permit automatic control of RTTY and data communications in certain small segments of 10, 12, 15, 17, 20, 30, 40 and 80 meter ham bands. The ARRL said internationally agreed upon band plan changes made the proposal both workable and acceptable to the majority of ham operators.

The League's petition runs to some 35 pages. The following is a capsule version of the points made by the ARRL.

(1.) The League's goal in submitting the petition is to encourage experimentation, development and refinement of modern automatically controlled data communications . . . and to improve emergency and pub-

Continued on page 4

Tiger Scouts Visit Radio Club Station

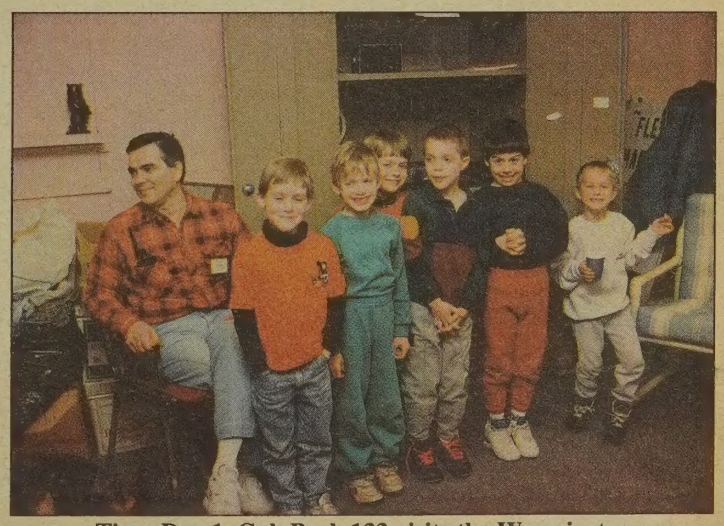
Tiger Den 1, Cub Pack 133 visited the club station of Warminster (PA) Amateur Radio Club (WA3DFU), located in the Benjamin Wilson Senior Center, on Monday evening, February 8, to learn about ham radio.

Warminster resident George Brechmann (N3HBT), who oversees activities at the club station, explained to the young visitors and their parents the role ham radio plays—both as a hobby and as a public service activity—for those who participate. "Ham radio allows you the chance to make new friends all over the world by having conversations with them by two-way radio. It's also a great way for kids to enhance their communications skills," he noted. The visitors had an opportunity to talk with another ham in Colorado on 17 meters using the station's HF equipment, as well as with some local hams on the club repeater.

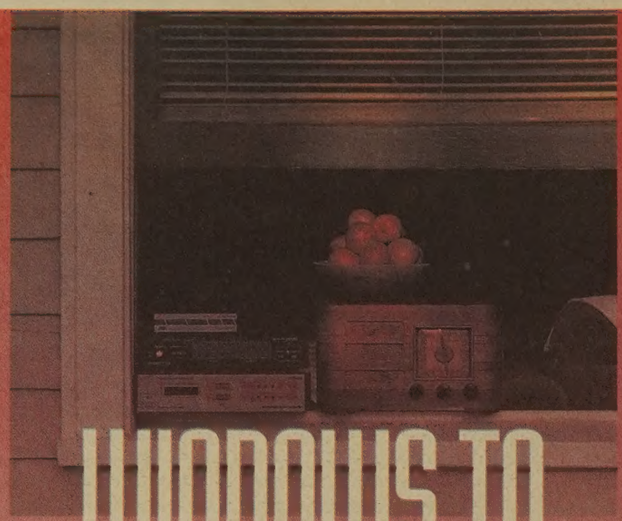
The connection to learn more about other countries fits well with the Tiger Scout Promise: "I promise to love God, my family, and my country and to *learn more about the world.*" Tiger Cubs is an activity associated with the Cub Scout program. First-grade boys sign up with an adult and have five objectives: to have fun together, know one another, grow together, get along together and discover together. "The key word is *together*," emphasizes Steve Larson KA3ZLY, a Warminster Club member who, along with his 7-year-old son Gregory, participates in the Tiger Den which meets at the Chalfont United Methodist Church. Parents try to find interesting activities to do with the boys and "ham radio fits right into the Tiger Scout Promise," according to Larson.

Youngsters attending the demonstration included Brandon Mezick, Christopher Mowery, Gregory Larson, Robert Scafidi, Kevin Singer and Steven Scafidi, pictured here with George and his seeing-eye dog, Nicole ("AK9DOG"). WARC volunteers included Scott Vogen KB3ALX and Bill Gorodetzer K3MFI.

The Warminster Amateur Radio Club, which is an ARRL Special Service Club, has over 200 members who are involved in all aspects of amateur radio. Members make a special effort to participate in community-oriented projects by providing communications support for events that recently included the March of Dimes WALKAMERICA walkathons, the Special Olympics, the Clean Air Challenge Bike Trek sponsored by the American Lung Association, community road rallies, 10K and fun-runs, and weather exercise and disaster drills testing the warning and notification systems for local agencies.



Tiger Den 1, Cub Pack 133 visits the Warminster Amateur Radio Club, finding an activity that fits well with their Tiger Scout Promise.



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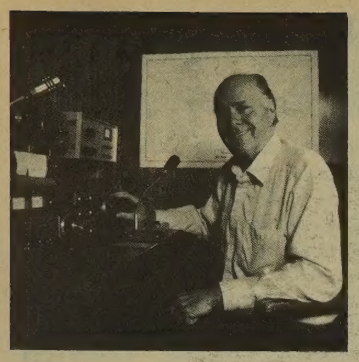

QLF by Wayne Green W2NSD/1

Howcome *Radio Fun?*

At times I feel like a stranger in this mendacious and greedy world. I'm publishing Radio Fun because I want as many newcomers to hamming as possible to find out how much fun can be had with this great hobby. Amateur radio has provided me with a lifetime of fun and excitement and, no doubt due to some genetic defect, I have this drive to share the things I enjoy with as many people as possible. Though this has caused me endless problems, I'm apparently powerless to change.

For instance, about four years ago I heard a young chap, Scott Kirby, playing Scott Joplin's ragtime music in a grungy little bar in New Orleans. His playing was so fantastic that I brought him to New Hampshire and started my own record company (Greener Pastures Records) just so more people could hear this incredible music. The first CD was recorded in a local church and was pretty good. We looked around for a better piano than the old church Steinway and found a wonderful 1896 Bradbury upright grand which had been lovingly restored by Knud Keller KV4CC. We fixed up my garage as a studio and recorded our second CD there. Better.

Then one day, while cleaning out my barn, it seemed like there might be enough room to build a true digital recording studio. The last two Scott Joplin CDs were recorded in what has turned out to be one of the most advanced recording studios in the country. Indeed, as I'm writing this Scott Kirby is busy doing the final of four CDs in a set of the Complete Scott Joplin rags, marches and waltzes.

Letters from hundreds of people who've bought the CDs, saying how much they love the music, pay for it all for me. However, as an entrepreneur I try to make sure that any project I start will eventually pay for itself. Nothing I've ever done has been for the main purpose of making money . . . or for losing it.

Now, I recognize that you probably have little interest in music and thus could care less about the CDs I've produced. That's a pity. Some of Joplin's music is so beautiful that I just sit there listening and cry. Many music lovers agree with me that Joplin was the most incredible composer America has ever produced. Not bad for a black man a hundred years ago.

It was my love of amateur radio that pushed me to start *73* magazine back in 1960. I felt there was a need for a magazine devoted largely to home building projects, and one dedicated to encouraging amateurs to explore new technologies. *CQ* was almost all monthly columns and *QST* was devoted largely to club news. I wanted hams to enjoy the fun of building and exploring new technologies.

How I Got Started

I was most fortunate to have a grandfather who was an inventor. Did well at it too. When you see a Citgo gas station you can remember that it was my grandfather who helped lay the groundwork for the company, back in 1909. That's an interesting story and I'll try to remember to tell you about it. He was interested in everything and infected me with whatever virus causes that problem for people.

Either an angel in disguise or perhaps Satan himself visited the Dutch Reform Church in Brooklyn (NY) one day in 1937 and gave my best friend a box of radio parts. Alfie had no interest in 'em, so he gave the box to me. Wow! They were all still in their original boxes. The local radio store said they were worthless . . . way out of date. I rummaged through a stack of *Popular Mechanics* and found a circuit which used many of the parts to build a cigar-box radio. Then came what probably was the turning point disaster of my life . . . the radio worked! I was hooked.

It took me several months to discover that radio parts were available at wholesale prices. At first I bought tubes from local radio stores. A typical tube listed for $1.20, which is like $20 in today's dollarettes. Once I discovered "Wholesale Radio" on Sixth Avenue in New York the prices for everything dropped about 60% and my building escalated, fed by unspent school lunch money. The company changed its name to "Radio, Wire, Television," and eventually to "Lafayette Radio." Those list prices were for showing to the radio repair store customers to justify the outrageous repair bills.

Naturally I joined my school radio club (Erasmus Hall High School) and got busy studying for my ham license. In 1938 the first license required 13 wpm code and a technical test equivalent to today's General class license. I enjoyed getting on the air from the club station W2ANU. I built an all-band receiver and did a lot of shortwave listening. As a kid on roller skates I visited just about every active ham in Brooklyn.

In those days there were three classes of license. There was Class C, a mail order license which was only available to people living more than 75 miles from an FCC examining point. The Class C privileges were the same as Class B, which was the entry license, and permitted us to operate CW on all bands and phone on 10m and 160m. In the 1930s 10m was a VHF pioneering band and anything above that (5 and 2.5 meters) was being explored by only a handful of experimenters.

My first exposure to amateur radio was when my grandfather took me to visit Fred Stevenson W1CUN, who had a shack set up out in back of a hotel in Bethlehem (NH). His mother, Mamie Stevenson, was the pastry cook at the hotel. The hotel was owned and run by Johnny Macauley, a good friend of my folks. I was impressed as Fred sat there talking with friends over his obviously homemade ham rig. That was about five years before Satan dumped the radio parts on me, so I had no idea that one day in 1946, fourteen years later, I'd be sitting in that same shack with my own homemade ham station, talking with friends all over the world.

I'll never forget my first hamfest in 1938. Several of the Brooklyn hams were going and invited me to go along. One was a CW whiz and was used to winning CW contests at hamfests. Impressive company for a kid. But he couldn't hold a candle to McElroy, the national CW champion. There he was, sitting there copying code at around 75 wpm. The code was blasting away, while he answered questions and talked with anyone passing by. Every so often he'd turn and attack his typewriter with a frenzy and catch up on what was being sent, never pausing in his conversations. Oh yes, he was also the world's champion typist.

The biggest activity around Brooklyn in those days was on 160m. The band was packed with low power rigs, usually 5 watts to a crystal-controlled 6L6 oscillator, with a 6L6 modulator and a carbon microphone (an F1 mike stolen from a pay phone). In those days duplex operation was allowed, so four to eight stations would rebroadcast each other, allowing a round-table conversation where everyone could hear everyone else, making the contacts like sitting around a room talking. Wow, that was fun!

With that low power and half the stations on the high end of the band and the other half on the low end, we could rebroadcast each other without feedback.

I spent a lot of time visiting Walt Zuckerman W2LBF, who lived a few blocks from me, and talking over his station. I think it was in January 1939 that the FCC made duplex illegal. Oh, they didn't do it on purpose, their aim was to stop a few bothersome hams from playing phonograph records for hours. The new rule said that all transmitting had to be for the purposes of two-way communicating. Duplex operation never occurred to them, but it didn't take any time for an officious monitoring station to decide that duplex was now illegal. Pity.

Walt eventually moved to Sherman Oaks as WA6BMG, where I occasionally ran into him on 20m.

The Code

I tried three times to pass the 13-per code test at the New York FCC offices. I hadn't had any problem learning the code. I had to know the code for the Boy Scouts so I learned the letters and numbers one night while getting dressed to go to a meeting.

Getting that 13-per was more difficult. I practiced several hours, but the problem was my freezing up in panic at the test. It happened three times, but I was so busy building stuff and having fun making contacts on 40m CW as a bootlegger (the name for pirates at the time) that I didn't push it.

High school kept me pretty busy. In addition to the radio club I was also a member of the Choral Club, which practiced an hour every day. I was also a member of the Savoyards . . . we put on The Mikado before an audience of about 8,000 students . . . I played Koko; the Camera Club; the Book Club, and so on. I was into everything. I hate to think how many hours I spent in the darkroom learning to process film and making enlargements. That was exciting too.

When I got to college I joined the radio club (W2SZ). One of the club members asked if I'd go with him while he took his exam. Sure, why not. So I practiced the code for a couple more hours the night before and drove with him to Schenectady for the exam. He'd been copying everything solid at 15 per the night before, while I'd been missing a few letters. I knew I'd only fail again, so I didn't bother to practice much and didn't even look at the Q&A book for the written exam.

We sat down and the code began. Lordy, it sounded slow! I had no problem getting solid copy. At the end I turned around and looked behind me at my friend's paper. It was mostly blank! He'd panicked. So I did the written exam and a few weeks later an FCC envelope arrived with my W2NSD license in it. My friend never tried again. Amateur radio lost a cracker-jack engineer.

Continued on page 7

Put Some Backbone Into Your Next Dipole

by Wayne Mishler KG5BI

The backbone of a dipole antenna is its center connection. And the ideal dipole center is one that's mechanically strong, easy to build, electrically efficient, and impervious to weather.

Dipole centers are available commercially, but one of the best can be easily constructed in a few minutes using a simple SO-239 socket.

All of the materials needed are available at Radio Shack: an SO-239 chassis-mount socket (278-201), two mini-egg insulators (278-1335), and a roll of 14-gauge copper antenna wire (278-1329). You'll also need a small quantity of quick-dry epoxy glue to weatherproof the SO-239, possibly two additional insulators for the antenna ends, and nylon cord for hanging the antenna.

Construction

Connect two insulators to screw holes on opposite sides of the SO-239 with short pieces of antenna wire as shown in the illustration. Fasten the wires by twisting. Trim off the excess wire ends and solder the twists to make them permanent. These wires are used for support only; it is not necessary to solder them to the SO-239.

Cut two 12" lengths of antenna wire. These will be used as jumper wires to connect the SO-239 to the two legs of the dipole. Tin one end of each jumper. Solder the tinned end of one jumper to the center terminal of the SO-239. Make sure it is a good electrical connection. Insert the other end into either of the remaining screw holes in the SO-239 and solder. This is also an electrical connection so make sure it is a good one; it is easy to get a cold solder joint here.

Connect the Dipole Legs

Measure and cut two lengths of antenna wire 2' longer than necessary for the *lowest* frequency on which you will operate (468 divided by Frequency in MHz = Total Length in feet. Divide by two for the length of each side.) These will be the two legs of your dipole.

Attach these wires to the insulators as shown in Figure 1. Now connect the jumper from the SO-239 center terminal to one of the dipole legs and solder as shown in the illustration. Similarly connect the jumper from the SO-239 screw hole to the other dipole leg. Keep the jumpers short so they cannot possibly touch each other when the dipole is hung.

Mix a small amount of fast-dry epoxy glue. Quickly and thoroughly coat the center terminal of the SO-239 and the insulation material in which it is supported. This forms a watertight seal over the top of the connector, which is essential to keep moisture out of your coax. Do not allow any of the glue to get on or into the socket portion (threaded end) of the SO-239. Allow the glue to dry.

Hang and Tune

Hang and tune the antenna in the usual way. The two legs of the antenna can be terminated with insulators to simplify hanging. Temporarily attach nylon cord to the ends of the antenna and hang it from two trees or roof supports. Keep it as far away from metal objects as possible. Connect your transmitter to the antenna using 50-ohm coax. Tape the coax connection to keep out moisture.

Being careful not to interfere with others on the air, tune the antenna by briefly applying low power (20 watts or less) and measuring reflected power with an SWR meter. With the transmitter power off, prune equal amounts off each end and test until the SWR is near 1:1 at the center of the band.

When tuning is completed, terminate the two legs of the antenna with egg insulators. Tape the coax connection to keep out moisture.

Feed the antenna directly (without an antenna tuner) when transmitting on the band for which it was cut and tuned. An antenna tuner will enable you to use the antenna effectively on bands of higher frequencies.

In pouring rain, ice, wind—anything *except lightning!*—you'll enjoy many hours of operation from the comfort of your warm shack, knowing that the backbone of your all-weather dipole will endure. RF

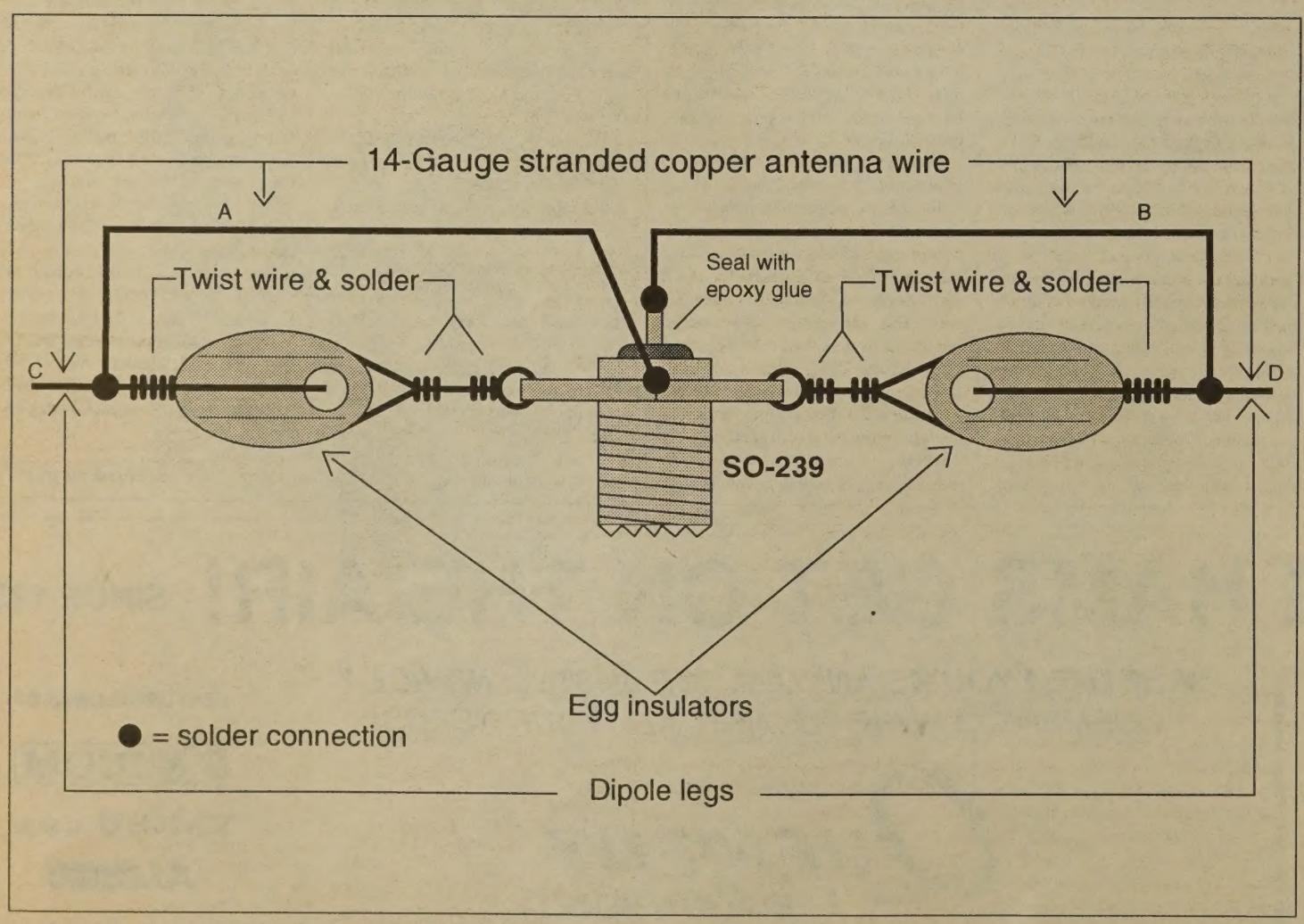

Figure 1. Connect the insulators to screw holes in opposite corners of SO-239 with short lengths of 14-gauge stranded antenna wire as shown. Make twists permanent by soldering. Solder one end of jumper wire A to either of the two remaining holes in the SO-239 base (ground) and the other end to dipole leg C. Solder jumper wire B to the SO-239 center terminal (positive) and the other end to dipole leg D. Keep connector wires as short as possible. Mix a small amount of quick-dry epoxy glue and use it to seal the top of SO-239. When this dries, hang the dipole by its ends. Connect SO-239 to the rig using 50-ohm coax. Tune the antenna to frequency using an SWR meter.

Packet Petition

Continued from page 1

lic service communications.

(2.) The National Telecommunications and Information Administration agrees that the Amateur Service performs a vital role in adapting complicated and expensive technologies to useful communications systems. NTIA is the White House advisor on telecommunications matters. Digital communications networks are advancing at a rapid pace.

(3.) Current data operation in the HF bands includes RTTY, AMTOR, and packet radio. The Amateur Service is also experimenting with such new spectrum-efficient error-correcting digital modes as "Clover" and "Pactor."

(4.) The current rules do not permit automatic networking below 50 MHz and third party communications must use the AX.25 packet protocol. This requirement was based on an ARRL proposal . . . although many amateurs also want automatic high frequency networking authority as well.

(5.) The FCC was properly concerned that automatic "robot" stations will interfere with locally controlled users on the high frequency bands. Several petitions for reconsideration were filed. The ARRL suggested that a small group of data communications enthusiasts determine the feasibility of permanent HF data communications.

(6.) The first STA request was granted in 1987 for a six-month period and has been renewed ever since. HF packet works well, moves traffic—and, with careful frequency selection, provides a public service without undue interference to other amateur activities. But HF packet radio is not compatible with other modes and need separate frequencies.

(7.) The League proposed a plan (RM-7248) in early 1990 that would permit automatically-controlled HF data communications based on a new IARU Region 2 regional band planning effort.

The *International Amateur Radio Union* (IARU) is the worldwide union of national amateur radio societies. It is an international organization that is recognized by the ITU as representing the amateur and amateur-satellite services throughout the world. It is comprised of 126 member societies and is organized into three Regions corresponding with those of the ITU.

The ARRL petition was withdrawn two months later to consider other options for automatic control. These options would be developed through the work of a committee of interested amateurs.

(8.) A January 1992 *QST* survey on automatic digital communications gathered more than 500 responses which were considered by the League's Board of Directors at their meeting in July. It was clear that there should be no band-wide automatic control of HF digital messaging . . . any such operation should be within specific subbands. "The League was faced with the dilemma of its obligation to comply with the band plan for such established by international agreement, and the

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Radio Fun

APRIL 1993
issue #21

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RADIO FUN (ISSN 1055-887X) is published monthly by Radio Fun, a division of Wayne Green, Inc., 70 Route 202-N, Peterborough NH 03458. Subscriptions: $14.00 per year. Canada add $8.00. Foreign add $12.00 surface/$32.00 airmail.

Printed in the U.S.A. by Lighthouse Press, Manchester, NH.

POSTMASTER: Send address corrections to RADIO FUN, P.O. Box 4926, Manchester NH 03108.

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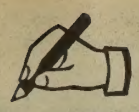

Write to: Radio Fun, 70 Route 202-N, Peterborough, NH 03458

David W. Michelson, Saginaw MI Heritage High School in Saginaw Township, Michigan, is starting an amateur radio club (the HHSARC). We have an excellent core of students, including a senior who will enter the Coast Guard upon graduation (KB8NNU/AG) and a foreign student from Indonesia (YD5ING). I will be their sponsor and am looking forward to a long relationship with this activity. I am a former teacher, have coached the high school hockey team for 21 years, and have children in the 2nd, 3rd and 5th grades who are looking forward to amateur radio at the high school.

I planned on initiating club activities this fall, understanding the slow process of club approval and gaining access to sole use of a room at the school. However, after submitting excellent materials from the ARRL regarding an interdisciplinary approach for amateur radio, plus my own materials, the room was quickly approved, the club was started, and there was much excitement over this long-term project.

Needless to say, we have no materials, rigs, wire, crying towels or . . . ?*&%$#@! We understand that every club faces this problem. Let us sincerely thank you for considering our solicitation now and not merely as a ritualistic closing—we mean it!

As a club we have goals beyond the normal "create a station" mode. I believe we should try to incorporate modes of amateur radio in the curriculum, not as a separate entity and, yes, as a multidisciplinary approach, but even more as a "resource" for teachers. If teachers' needs are met (ways they can use amateur radio within their individually specific method of teaching) they will gain ownership and interest. Specifically, one teacher at Heritage would like facsimile weather maps. With our approach, we will implement this mode of amateur radio as a priority because a teacher (non-ham) would like to use it with his students in the classroom, even though it would not otherwise have been selected as one of our priorities. This process is a teaching resource approach to amateur radio. It will begin with a presentation at the teachers' orientation meeting this fall. This allows teachers to determine which mode they may have interest in (for their students). We will present the demonstration and a cafeteria of possibilities of choices—they, the teachers, will select potential uses. Certainly, the normal club activities, HF rig, and 2 meter operation will keep the interest of regular ham radio students.

Right now, while these students' interest (some are already hams) is so high, please help us get started. We can use any rigs (new, returned, or falling apart), keys, antennas, money ($), written material, subscriptions, software, maps, charts, forms . . . anything . . . yes, even a strip of wire! (Send donations to David W. Michelson, Heritage High School, 3465 N. Center Rd., Saginaw MI 48603.)

Our focus, since we do not yet have equipment, is to coordinate our activities in the curricular area of marketing and public relations. Plaques and engraved name plates indicating donors will be used on all equipment. Stick tags with donors' names will be used on all written materials and wall hangings. Our literature and reports to area ham clubs and all community activities will include a section with our donors' names and their donation.

Thanks so much for your consideration in our efforts to promote the hobby of amateur radio for our youth and to investigate methods of introducing it into the curriculum. We will also update donors on our activities when possible.

Since I travel throughout the state to schools, my personal goal is to promote amateur radio as an excellent resource for schools in the regular curriculum—not merely as an extracurricular activity.

Scott Moore, Sioux City IA I've been an electronics and radio enthusiast for years and I'm finally coming home to ham radio. What's taken me so long? I can't afford a rig that costs $2,000-$7,000. This alone leaves my resources very limited. I can't find used gear and the hamfests always happen without me knowing about them (I guess they don't believe in advertisements). I could buy used gear through the mail, but do I really want to send $500 to someone I don't know for a radio I can't see?

So what about the kits? There are plenty of kits for CW, all kinds of accessories, and even repeaters, but I still can't find an HF SSB rig in kit form. Some people would say that ICs and circuit complexity make kit building impractical and hard. What a poor, poor excuse. ICs are cheap and easy to use. Some say that ICs take the satisfaction out of kit building, but that's simply not true. They save time and make me look like a genius when my friends see a circuit I built with one or two ICs in it. As for the circuit complexity, that's another poor excuse. I really don't need 100 memories, DSP, multiple VFOs, etc. SSB may be complex in itself, but any dummy who can use a soldering iron can build a kit.

It's no wonder that there are so few General class and above licensees, as compared with the Techs and Novices. Just look at the prices of these rigs and you can see why 10m SSB is so crowded: So few of us can afford to talk on any other HF band.

I'll finish this letter with a tip for your advertisers: Display your prices!!! I'm not going to call a company long distance because I can't afford it, unless of course I already know the price of the product. Put simply—I refuse to pay for a price quote, and I'm sure I'm not the only one who feels this way. I guess if I could afford one of those $5,000 radios the phone bill wouldn't be such a burden! RF

Why 468?

486/f(MHz) gives half-wave dipole length only in some instances.

by Dean Frazier NH6XK

Every new or would-be ham soon learns that the magic number 468 divided by the frequency in megahertz yields the length of a half-wave dipole in feet, each leg of which is half the value calculated. Soon he also discovers that this formula yields results that are less than desirable. When this happens, it is time to go back to basics and relearn and re-understand whence this formula comes so that its use can be tempered with a bit of judgment.

It begins with the speed of propagation of the electrical wave by which our radio communication is possible. Light, and electromagnetic energy is a form of light. It travels about 300,000,000 (or 3 x 10^8) meters per second in a vacuum and in air, itself almost a vacuum. This energy has a wavelength; that is, the electric component of the wave is oscillating at some frequency, measured in cycles per second. If the period of oscillation were once per second then one wave would pass you in one second, at the aforementioned speed, and you would say that the wavelength of this radiation is 3 x 10^8 meters. Since there are about 3.28 feet in a meter, you would also say that the wavelength is 3.28 x 3 x 10^8 feet, or 9.84 x 10^8, which is about 984,000,000 feet. This is for a full wave which oscillates once in a second, traveling at the speed of light. It turns out that since the electric part of the wave which we use to carry information to our fellow hams is of the form of a sinusoid (an up-and-down wiggle), when you look at it you see that only half the wave is needed since the wave is made up of two identical halves, one oscillating "up," and the other oscillating "down" (or one left, the other right, or whichever way you prefer . . . it's not important here). The point is that we need only half the wave for our radio transmission. Thus, we need only 984,000,000/2 = 492,000,000 feet for a half wave which oscillates once per second while traveling at the speed of light.

Calculating Dipole Lengths

Fortunately or unfortunately, light and all other electromagnetic radiations travel at this constant speed, that of light, unless slowed down in some other-than-vacuum-or-air medium, such as a conducting metal, and of course if stopped and absorbed by some opaque-to-light material. So we can't change the speed at which our transmission propagates through the air and through the vacuum beyond, but we can cause more than one vibration per second to occur . . . with our radio. If, for example, we transmitted with two vibrations per second, then the wavelength of each vibration would be 492,000,000/2 = 246,000,000 feet. If we caused two million vibrations per second, then each vibration would be of length 246,000,000/1,000,000 = 246 feet.

Now, 246 feet is half a wave on the 160 meter band, isn't it? Sure; 246 feet x 2 = one wave = 492 feet, which is about 160 meters.

Since our vibrations (from our rig) are in the millions of cycles per second, or megahertz, where 1 megahertz = 1 MHz = 1,000,000 oscillations in one second, we need only to divide our half-wave number of 492,000,000 by one million, yielding 492, and then if we divide this number by our operating frequency, expressed in MHz, we'll get the correct length in feet of a half wave for this frequency. Example: Operating at 28.4 MHz, for the length of a half wave in free space or (pretty nearly) in air, too, we get 492/28.4 = 17.32 feet.

But something is wrong here: Our 10 meter dipole for 28.4 MHz is shorter than 17.32 feet. How come? In fact, our dipole is more nearly 16.45 feet long, end to end, each leg being half this value. What's going on?

The Effect of Conductance

The answer lies in the fact that the electrical wave in our wire dipole is slowed down to about 95% of its free-space velocity . . . copper wire is a good conductor, but not as good as free space. And 95%, which is 0.95, of 17.32 feet is 0.95 x 17.32 = 16.45 feet, pretty nearly.

You guessed it: 492 x 0.95 = 468. Actually closer to 467 since the 492 number is more accurately 491.8, but we introduced an error immediately when we took the speed of light as 3 x 10^8 meters per second; it's a bit less, in fact.

So, the 468/f(MHz) is a good formula for when the ratio of the speed of the wave in the antenna conductor to that in free space is about 0.95. BUT, and this is a big but, the EFFECTIVE speed of the wave in the conductor used for our antenna can be different than 0.95 that of light speed, due to the thickness of the conductor compared to a free-space half wave at the desired frequency (i.e. as we make our antenna of thicker and thicker material). For example, as we build antennas for the lower frequency bands, the factor of 0.95 gets further and further from what it should be to give us a formula which predicts the correct length of a half wave *in the antenna material*. And what is worse, if we make our antennas more than half a wavelength at the desired frequency, as in longwire antennas, the factor 0.95, whence comes the 468, gets more and more out of step from what is needed.

Using "k" Factors

When this situation occurs, we resort to getting a "k" factor, which is a fuzzy way of "fudging" the wave velocity and all factors such as end-effect and antenna material thickness, into one multiplying number by which we correct, i.e. multiply, the 492 to come up with a corrected "468," which is then divided by the frequency in MHz to get the length of the half wave in this material at the desired frequency. Tables of "k" factors are found in various manuals, and the entry data to extract a "k" value is the free-space half wavelength divided by the mean diameter of the radiator, both expressed in the same units, of course.

The point of all of this is for you to realize that 468/f(MHz) is useful for WIRE antennas, and in this respect, for half-wave-dipole use. So we use it with a somewhat tongue-in-cheek attitude. It is to take the half-wave free-space wavelength say, in inches, and divide by the average thickness of our radiator material, also in inches, and use this number to enter a table of velocity-factor "k" values to extract a proper "k" value which we then multiply 492 by to get a "better 468."

Let's get specific: Suppose we want to build a simple half-wave dipole for 20 meters out of aluminum tubing , with resonance centered on 14.2 MHz. We have calculated that our average tube diameter, considering all tubing, large and small, will be 7/8", e.g., 0.875. This takes into consideration 1/4" diameter tubing for the element tips, and 1-1/4" diameter tubing for the sections of the elements in the center. We calculate the free-space half wave, in inches, at this frequency as: 492 x 12/14.2 = 415.77 inches. Dividing this value by 0.875 yields about 475. *This* is our entry value to find a "k." Reading a typical k-value chart in one of the several manuals, we see that for entry 475 we get a k = 0.968. Remember that the "k" in 468 was about 0.95? Well, when we take 492 and multiply by 0.968, we get about 476, *Not* 468. Then, with 476/14.2, we see we need 33.52 feet with our tubing to have a half wave, *not* 468/14.2 = 32.96 feet. Had we used the 468, we would have been 0.58 feet off, or about 7"! That's a lot when you are trying to maximize your antenna's resonance.

So there you have it. Use 468/f(MHz) with care, for half-wave antennas of wire. Better yet, do the calculations to get a good "k" value, and use 492 x k/f(MHz). You'll initially cut your antenna closer to where it should be in free space, and subsequent trimming and tuning will be easier and entail less work, especially if you cut short and have to add antenna material, as you are more likely to do when you use the dreaded "468." RF

QLF

Continued from page 3

The day my license arrived I got right on 2.5m and made my first legal NSD contact. I'd built a little transceiver while I was in high school . . . a 1G4GT, modulated by a 1Q5GT, a long-lines rig built from an article in *Radio*. That was the Bible for us builders at the time. *QST* didn't even come close. Yes, I joined the ARRL in 1938 and got my 50-year pin in 1988, plus a nice wall plaque.

My ham radio experience in high school was what got me into Rensselaer Polytechnical Institute. I'd planned to go to Dartmouth, having been born in New Hampshire. Maybe be a lawyer or something. But career advisory specialists gave us tests and said I had one of the highest mechanical aptitudes they'd ever measured and I just had to go to an engineering college. Alas, I wasn't smart enough to know better, so I followed their advice.

MIT was my first choice, but they took one look at my grades and laughed. RPI was supposed to be the second best engineering school, so I tried there . . . and was accepted.

I had a lot of fun with amateur radio at RPI. Alas, a year after I started there WWII came along and we were put off the air. But I got a lot of interesting hamming in before the lid came down. Remind me to tell you about it sometime, if you're interested. You probably could care less what hamming was like in 1940 and how this got me into the Navy as a technician. That was back when all ham rigs were homemade. Well, almost all. National Radio did have a National 600 which put out 600 watts and cost $600. That's over $10,000 in today's Monopoly money, so not many hams bought 'em. I managed to get one after the war from a ham in Boston and I had a great time with it for the next 20 years.

Oh, I forgot to tell you about the new Hallicrafters receiver they were showing at that 1938 hamfest. It was the Skyrider Diversity. It had two complete receivers which were tuned in tandem. You hooked two antennas to them, one vertical and the other horizontal, and they greatly reduced fading problems. What a beauty! Naturally it cost a fortune.

I didn't bother getting my Class A license until after the war, when they opened 20m. That license permitted phone operation in the 20m and 75m phone bands. There was no 40m phone band at the time. These bands were 100 kHz (kc) wide and tended to be dominated by nine round tables made up of kilowatt AM stations. The 50-watt stations most of us could afford to build weren't even acknowledged if we were dumb enough to try and call into one of those round tables. It wasn't until war surplus parts made kilowatt rigs cheap to build that anyone but the very rich could afford them.

After the war the 20m and 75m phone bands were expanded. But the real change was single-sideband. I'll tell you how that came about some time.

Tell Me, Tell Me

I want to hear from you. Are you interested in getting on packet? How about satellite communications? DXing? Winning contests? Microwaves? Moonbounce? Slow-scan TV? Fast-scan? RTTY? High-speed computerized CW? Repeaters? Traffic handling? Hidden transmitter hunts? Club activities? Field Day? MARS? Service nets? Going on DXpeditions? Aurora contacts? Building gadgets?

I've done 'em all and have some great stories to tell . . . but only if you're interested. I'm not going to sit down and write Uncle Wayne columns unless you really would like to read 'em. Like the time I worked seven states on 10 GHz, a feat no one has ever duplicated, even during VHF contests.

The whole idea behind this publication is to help you discover the fun that's to be had in amateur radio. You don't have to settle for a lifetime of the handle, here is Wayne, your report is five by nine, and over to you, contacts.

If you decide to take up a new aspect of hamming please keep a log of your progress . . . and your problems. You see, my hope is to get you to write for *Radio Fun*, telling the readers what it took for you to get into a new ham activity. In this way you'll encourage others to give it a try, plus you'll help them avoid the problems you ran into. It doesn't take long when you get started with something new before you're an "expert," at least as far as those of us who haven't tried it yet are concerned. RF

RF vintage review

The Kenwood TR-8400

by Dave Mackey K1KA

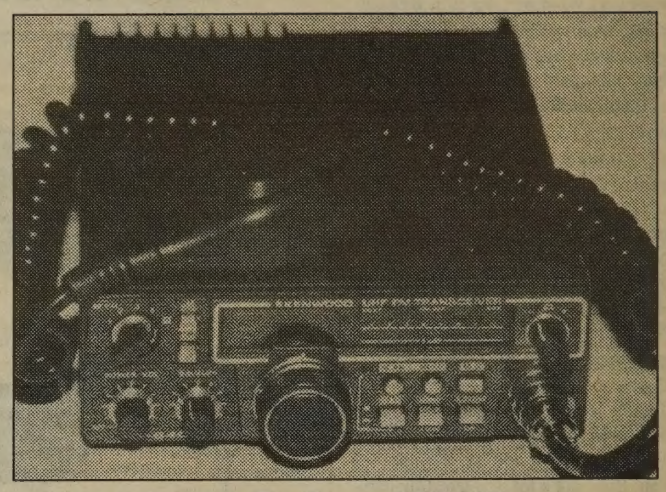

Photo A. The Kenwood TR-8400.

Those new smaller, more fuel-efficient cars really put the pressure on amateur manufacturers for new, smaller, more space-efficient mobile rigs. (I often wonder what car dealers think when the first thing I do in their showroom is survey under the dash for space availability and ease of wiring in that new prospective car.) Well, if you're into 440 MHz FM, the folks at Kenwood have sure made life easier. The TR-8400 is downright tiny. Measuring just 2" high by 5-3/4" wide by 8" deep, the radio will easily fit into even the smallest car.

But don't let the small size fool you. The 8400 is a microprocessor-controlled 10 watt rig with memories, scanning, and all those niceties that state-of-the art computer technology provides.

Features

Two VFOs designated "A" and "B" step in 25 kHz increments, which is compatible with the US and Canadian band plans. Five memory channels can be stored and recalled with either a five-position switch or with the scanning function. Memory 5 can be used for operation of repeaters with other than 5 MHz frequency splits. On this channel, the transmit and receive channels are memorized separately. Channels 1-4 as well as the VFOs are preset to provide a plus or minus 5 MHz split. In addition, simplex operation can be selected.

Two types of scanning are provided: memory scanning and band scanning. In the memory-scan mode, each of the live channels is scanned at a rate of one channel per second. Band scanning is at a much faster rate, described in the manual as 120 ms per channel (about a tenth of a second). This may seem fast, but when you are considering that the entire 10 MHz wide band is being scanned, this rate is fine. Scanning the entire band takes only 50 seconds. If the squelch is opened by a signal, then scanning stops until the signal disappears, then scanning resumes from that frequency. If you want to listen further to that conversation, you must disable the scan function with the front-panel switch or by momentarily depressing the push-to-talk button on the mike.

A tone switch is provided on the front panel to enable or disable either a subaudible tone or tone burst for repeaters that use this feature. It should be noted that Kenwood does not offer the actual tone module that is required, but the radio is compatible with standard products available from a number of sources; the manual even describes the installation procedure. Similarly, the TR-8400 includes an input for a separate autopatch Touch-Tone™ pad.

The RF power output is 10 watts with a lower power level of 1 watt.

One of the best features of the 8400 for me was the microphone with up/down tuning buttons. Each push of the button advanced the tuning one step, which was indicated not only by the display changing, but also by a built-in beeper. Holding down the appropriate button doubles the scan rate and is indicated by a continuous tone.

Controls, Displays, Connections

Despite the small area available on the front panel, the controls are well laid out and easy to use. As shown in the photo, the memory-channel selection switch appears in the upper left corner, with the memory programming and memory recall buttons to the immediate right. The memory recall button switches between the VFOs and the memory channels. Below are the volume and squelch controls. The main tuning knob dominates the front panel and clicks off channels in 25 kHz steps. Each revolution moves you 1.25 MHz up or down so you can move quite rapidly between band edges. When you reach the edge, the microprocessor automatically starts you at the other end of the band. With a little forethought, you quickly start to think of the band as a circle. Any frequency can be reached by tuning up or down once you know the shortest route.

To the right of the main tuning knob is a cluster of six buttons in two rows. The top row controls scanning. The SCAN and HOLD buttons start and stop the scan function, and the M.S. (Memory Scan) selects either VFO scanning or memory scanning as described earlier. On the bottom row is the VFO select button ("A" or "B"). An LED lights to indicate when VFO "B" has been selected. A high/low power switch and the tone activation switch are also included. Above the microphone connection is a three-position rotary switch for selecting the transmit frequency shift, plus or minus, or simplex operation. A five-digit red LED numeric readout indicates frequency down to the whole kilohertz (example: 449.275 is shown as 9.275).

An LED light bar shows both RF power output and relative received signal strength. Individual LEDs indicate busy channels, transit mode, and repeater operations.

Rear-panel connections are provided for an external speaker, a tone-pad input, DC power, and an antenna.

On-the-Air Operation

I'm sure that in the design of any radio there are certain trade-offs to be considered, especially when so much is packed into such a small space. However, if there were trade-offs here, they did not affect the performance of the radio. Even the receiver audio output was in abundance and the speaker could be driven loudly and still produce a crisp sound. Transmitted audio reports were also excellent, and no operational problems of any sort were experienced with the radio. By far my favorite feature was the microphone with its up and down frequency buttons. Talk about being addicted to video games! After a few hours with readouts flashing and beeper beeping, I could land on a channel at will practically with my eyes closed.

I did manage to come up with a few ideas for possible future refinements. I am personally a bit partial to the use of type N antenna connectors at these frequencies and the one provided was a so-called UHF type. The digital readout is a bit difficult to see in direct sunlight, as are many others. The readout does not indicate the transmit frequency, but only the received frequency, even in the transmit mode.

Manual

The manual is very understandable and has numerous pictorial diagrams. All functions and features are fully described. A block diagram and schematic are included, but there is little information regarding the circuitry. A separate service manual is available which contains this information.

Summary

The TR-8400 is both enjoyable and reliable. The features are well thought out to provide plenty of utility without a lot of complexity. This is an important consideration when selecting any mobile radio. RF

Reprinted from the October 1983 issue of 73 Amateur Radio's Technical Journal.

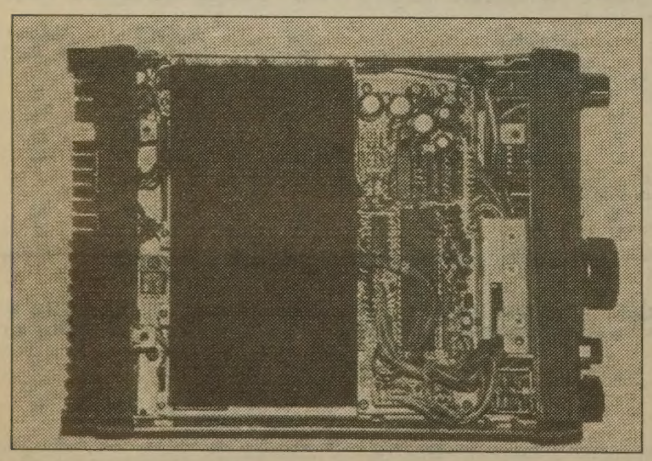

Photo B. Top view.

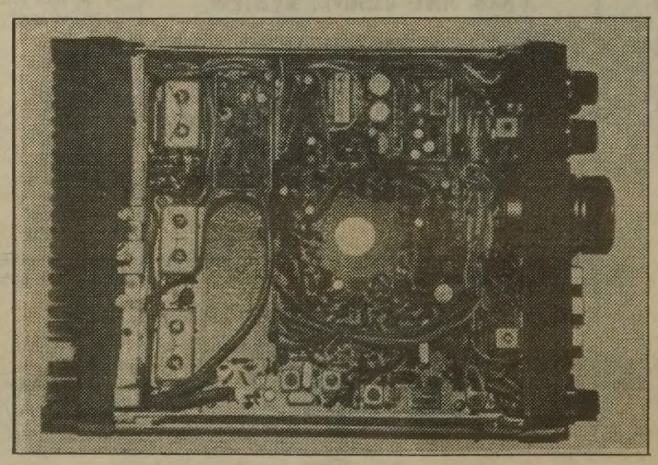

Photo C. Bottom view.

Take Your New Act on the Road

by Alan Bosch KD4FRK

Hamming at home opens a whole new world of acquaintances, information, and service opportunities. Hamming on the road can do all that, and add a measure of security unavailable from other radio services.

"Fine," you say. "I already have my car equipped for mobile work." But what if the context is a trip where you have to fly somewhere and rent a car?

Here are some thoughts about a package that can be carried in one hand, will withstand thumps and bumps, and will let you get out nicely from a vehicle or motel.

Construction

The first ingredient is a case approximately 12" x 12" x 6"—say, for a camera or recording gear. That volume will swallow a surprising amount of stuff. Mine happens to be from a paint-reflectance tester and has two compartments: one 10" x 12", and one 2" x 12".

The second ingredient is some large blocks of expanded urethane foam (but not styrofoam) that you can cut cavities in for your HT, batteries, speaker-mike, etc. The foam fits in the larger compartment of my case. One block sits in the bottom and has the cavities; the other sits atop it. Closing the lid compresses them slightly so nothing goes anywhere inside.

The simplest way to make the cavities—after you have outlined the item on the foam with a felt-tipped pen—is to cut all the way down through it with a short, serrated steak knife. Then put the equipment item in the hole, insert the foam-plug from below, adjust things so the equipment is snuggled in to about half its depth, then slice off the foam that protrudes. Finally, remove the gear, reposition things so the foam plug is flush with the bottom of the larger block, and glue it in with Elmer's Glue.

What to Pack

What to include in the package? Mine has spaces in the foam-lined section for a dual-band HT, speaker-mike, two batteries, and a "universal" wall-charger with variable voltage and polarity and one of those four-plug cable ends.

The smaller section holds a 6-foot power cable with a lighter plug, 12 feet of RG-58 with a BNC at one end, a twin-lead J-pole, and a home-brew mobile antenna.

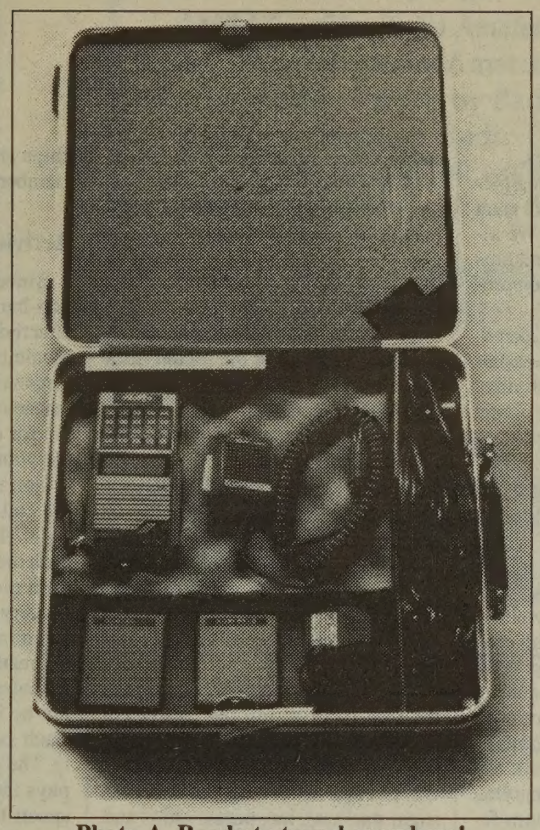

Photo A. Ready to travel anywhere!

The antennas, of course, are the key to getting out. My J-pole has a rubber band looped into its upper end so it can be hung from motel ceiling lights and curtain rods—and anywhere on any window with one or two of those suction-cup hooks from a "sun-catcher," or even up in a tree with some nylon twine that has a fishing sinker tied on one end.

The mobile antenna has two parts. The first is a mag-mount base that once held an 11m center-loaded whip. It has standard 3/8" x 24 threads and a 4' RG-58 pigtail with an in-line SO-239 termination. The second is a five-section whip from a deceased AM-FM portable. It is 21" long when fully extended and has a 4-40 machine screw fitting in its base.

Drilling out the 3/8" x 24 adaptor that held the old center-load in the mag-mount allowed me to fasten the new whip to it by simply running a longer machine screw up through the adaptor. This assembly screws right into the mag-mount, is sturdy enough to ride unwaveringly on a car roof at any posted speed, and is easily adjustable.

Tuning the whip involves simply pushing its top section in two-thirds of the way (a position I've indicated on it with a permanent marker). That shortens it to 19", and the SWRs check out around 1.3:1 on both 2m and 440.

Indeed, tuning doesn't seem to be critical with this combo. Pushing the top section in all the way shortens the whip to 18". That length yields SWRs of 1.5:1 or under on 2m and 440—and also in the GMRS band at 462-67 MHz.

When taken apart, it will fit in a windbreaker's pockets—whip, base, cables and all. So, if your're walking the dog and can't hold the repeater with your HT's duckie, just stick this skyhook on the nearest mailbox.

All in all, I have found this portable package a real boon. It will fit in any nook on a plane and doesn't raise the hackles of airport security (most are content just to X-ray it). It can be dropped without fear (and has slid off the roof of a car). It carries everything necessary for mobile or temporary-base work on two bands (and still has room for a 220 HT). It sets up very quickly (even in the woods). And it gets out (I've hit repeaters from as far as 60 miles away in Colorado and Wyoming with 5 watts).

So, make up one for yourself and take your new act on the road.

RF

Rejuvenate Your Club Membership With a Picnic

by Charles M. Seay Sr. KN4HL

The long cold winter has finally passed into the warm days of spring and summer. Club members need a tonic to rejuvenate their thoughts about the many facets of ham radio. Hams with non-ham spouses and/or children need some activity for the entire family to enjoy. A club picnic is the answer to the problem. This activity will bring club members and their families together.

The planning of the picnic is very important. Good planning will ensure that everyone has an opportunity to enjoy themselves, without the burden of a lot of work.

When?

Several questions arise concerning the picnic. What is the best time of the year, the best day of the week and the best time of day for the picnic? Generally, people like to be outdoors when the temperature is comfortable. Excessive heat and cold tend to curtail the activities at a picnic. The months of May and June have been ideal for our club. It's a great idea to incorporate a picnic into Field Day activities.

A fall picnic held during September or October is a great way to end the summer season with a bang. A survey of the club membership will determine which day of the week is best for a majority of members.

We have found that our spring picnic, which is usually in May, is a great time to hold club elections. We always have good attendance and thus more participation in the election process.

If the picnic is held on a weekend, the activities can usually start earlier in the day and more family activities can be incorporated into the picnic program. Picnics held during the week are usually shorter due to time constraints on each member.

Where?

Where do we hold the picnic? This question is easily answered if you live close to a city or state park with covered pavilions. Covered areas are needed in case of a sudden thunderstorm.

Notice the two covered pavilions shown in Photos A and B. Both of these pavilions are in a state park and can be reserved for club picnics. One of these pavilions has restroom facilities under the same roof as the picnic area; the other has a fireplace with restroom facilities nearby. Some city parks also have covered pavilions that have restroom facilities at the pavilion or nearby.

A roaring fire in the fireplace adds comfort and charm to the fall picnic and promotes "eyeball" QSOs. If covered facilities are not available, arrangements should be made for a tent in case of a sudden shower.

Planning the Food

Picnics should be structured so that the work of holding the picnic does not fall on the shoulders of just one or two club members or their spouses. I strongly suggest an add-a-dish type of picnic. Members or their spouses should be polled to determine what foods are planned by each family.

Please keep in mind that certain foods do not keep well and can cause severe sickness. This group of foods includes chicken dishes and all dishes with mayonnaise or salad dressing.

Club members should be assigned the task of bringing the following items to the picnic: paper plates, plastic eating utensils, soft drinks, coffee, coffee cups (including creamer and sugar packets), ice, potato chips and other snacks. All good cooks are eager to show off one or more of their special dishes. Everyone will enjoy the variety of food and no one will go home hungry. There will always be plenty for everyone.

Piping hot chili with extra condiments of cheddar cheese, onions, corn chips and peppers will give all club members a warm glow of satisfaction.

Activities

Since a club picnic is to include non-ham spouses and children, other activities should be included in the picnic program. Croquet, horseshoe throwing and badminton are excellent activities to make the outing pleasant for children and older folks who are young at heart.

For a fun way to raise money for the club, I suggest a White Elephant Sale. This is a club auction to which each member brings something to the club picnic in a plain brown paper grocery sack. Each sack is filled with one or more items which may or may not relate to amateur radio. Each sack is sealed at home and the sacks may not be inspected before the auction. Each sack is auctioned off separately. The person making the highest bid pays the club treasurer and then inspects the contents of the sack without allowing anyone else to do so. They can return the sack with its contents to be rebid; however, the money paid for the bag will stay with the club and the sack will be rebid later in the auction for additional revenue.

Each family should bring two or three folding lawn chairs to the picnic. There are never enough chairs at the picnic sites and some people will just want to sit and talk. Many lasting friendships are started in situations such as a club picnic.

Club members should not forget to ask hams and their families from surrounding cities and counties to attend the picnic. This is an excellent way to increase the membership base of the club. Hams in those communities may not have a club and might enjoy associating themselves with yours. Club members should make every guest feel welcome.

Don't forget to have a club member designated as a talk-in station for the picnic to give directions to the location, helping out-of-town guests arrive safely. This can be accomplished through a local 2 meter repeater or on a designated simplex frequency. Make sure that club members and invited guests know the talk-in frequency.

Family activities such as a club picnic are valuable to active hams by letting non-ham family members know that dad's, mom's or a child's amateur license and their association with the club enabled the rest of the family to attend and enjoy this outing. Non-ham members may decide to get their amateur radio license. Every spouse who is licensed recognizes the fact that when both mom and dad are licensed it makes amateur activities more enjoyable for the entire family.

A club picnic will put everyone in a great mood for the club's summer activities. Many club members consider the club picnic as a reward for a great showing on Field Day, which required lots of hard work and long operating hours. The idea is to relax and enjoy the food, fun and festivities. RF

Photo A. This pavilion in a Tennessee state park has restroom facilities under the roof. A covered facility or a tent is an absolute necessity in case of rain.

Photo B. A covered pavilion with a fireplace is the perfect place for piping hot chili on a cool fall afternoon or evening. This one is also in a Tennessee state park. Picnic tables are under the roof and restroom facilities are nearby.

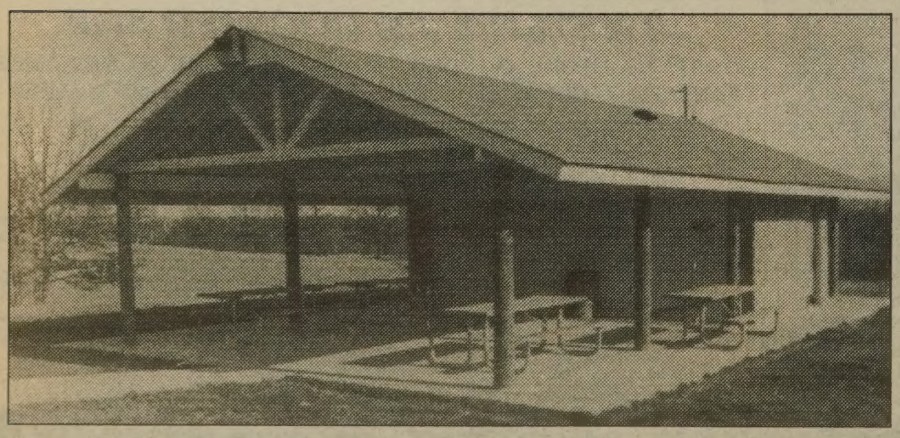

Photo C. This covered pavilion is located next to a field where club games can be held in association with picnic tables, and has plenty of room for additional chairs. This facility is provided by the City of Dickson, Tennessee, Dept. of Parks.

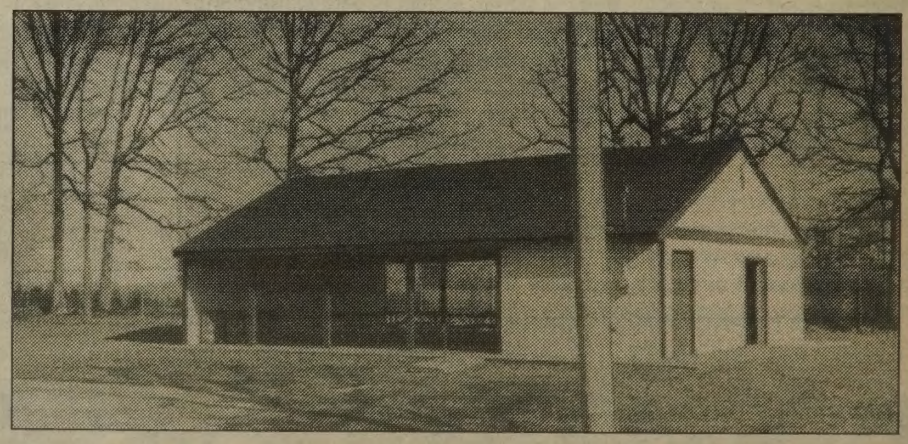

Photo D. This is a municipal pavilion, also operated by the City of Dickson, that has been used for Field Day activities in conjunction with a picnic.

An Antenna Like Grandpa Used to Make

by Paul Danzer N1II

In the late 1920s and throughout the 1930s, ham radio was quite different from how it is now. The use of high power transmitters was not common, and receivers were certainly not as good as they are now. Yet, a lot of DX was worked.

To successfully work long distances you need not only a transmitter and receiver, but also a good antenna. The old-timers spent quite a bit of time trying various antenna configurations—often using the "cut and try" technique rather than the theory, which was not always known or well understood.

Initially, antennas like those sketched in Figure 1 were popular. The first, called a "flat top," consisted of as many parallel wires as the supports could carry without collapsing. The wires were all tied together at one end and the resulting single wire feedline was continued into the shack. As far as we can tell today, this antenna worked on the theory that the more wire in the air the better!

A variation of this antenna was the "cage." Two circular supports were hoisted into the air and wire was run from one to the other, forming a cylinder. I guess it was called a cage because any bird blundering into one end stood a good chance of being captive until it found the other end.

Interestingly enough, the idea of synthesizing a very large (in diameter) conductor is used today by making a skeleton of parallel wires in a circle. It looks like the cage was simply an early attempt to make a very large-diameter single-wire antenna.

The Next Step: Resonance

The next improvement didn't occur until the idea of an antenna as a tuned element, with critical dimensions, was popularized. Then, suddenly, hams began to use the idea of tuning, and the dipole became commonplace.

Today we have a pretty good idea of how and why a dipole works. A basic dipole, as shown in Figure 2, is made by utilizing the formula:

Length in feet = 468/frequency (in MHz)

The old-timers had the same problem we have today—they wanted to operate on more than one band. One common trick they used at the time is shown in Figure 3. Either knife switches (as shown) or jumper chords were used to change the length of the dipole. For the example shown, the dipole operated on the 20 meter band with the switches closed. The dipole is held at each end on a pulley. To change bands the ends were lowered, the knife switches were opened, and the antenna was then re-hoisted into the air. Now the shortened dipole operates on 15 meters.

Today we solve the same problem by making multiband dipoles with traps. For example, there was an excellent write-up on this type of antenna ("Trap Dipoles" by Dean Frazier NH6XK) in the December 1992 issue of *Radio Fun*. However, if you want to duplicate what grandpa did, you can do so without lowering the antenna.

Grandpa's knife switch can be replaced by a mercury switch. It consists of a sealed glass tube and two contacts in the tube. Hold the tube one way and the mercury blob inside shorts the contacts. Turn the tube around and the mercury slides away, opening the connection.

A two-band dipole like the one shown in Figure 3 can be built with mercury switches like those shown in Figure 4. The assembly consists of two pieces of plastic, with the outer one about 5" long by 3" high, and the smaller one about 4" by 2".

Two screws are shown. The smaller plastic sheet pivots on the pivot screw, and its motion is stopped by the stop screw. At each bottom end of the smaller piece of plastic a length of monofilament is extended to the ground.

Pull down on the left monofilament and the mercury switch is opened. This is the position in the illustration. Pull on the right monofilament and the smaller plate tilts with the right end down, the mercury switch tilts, and the drop in the mercury in the glass tube shorts the two contacts, closing the switch. Thus, you have the equivalent of Grandpa's knife switch, but remotely operated from the ground.

Flexible braid connects the mercury switch to points A and B, and the dipole elements connect to A and B, replacing the knife switch.

A 1930s Eagle Catcher

Another design for a multiband dipole from this early period is shown in Figure 5. It really consists of several full-size dipoles, one for each band, using a common coax feedline. The top dipole, for the lowest band, forms the top of the array. Each succeeding dipole is spaced so its end is about one foot below the dipole above it. The plastic tubes are drilled and the wire or guy wire fed through the holes. Either cable clamps or small twisted sections of wire are mounted on each side of the tube wherever a wire goes through the tube.

Thus, the cable clamps or wire twists keep the tube in place.

Actually, today we can relate this design to a cut-off section of a wideband antenna called a "bow-tie," which in turn is a variation on a conical dipole. These designs became popular when UHF TV antennas became common.

I built one of these eagle catchers a few years ago just to see if this design really worked. So far as I could tell, it worked as well as a set of independent dipoles would have worked at that height. Amazingly (at least to me), there was very little interaction between the dipoles when I trimmed them for resonance.

I started by adjusting the length of the 10 meter dipole, and then did the 15 meter, 20 meter, and finally the 40 meter dipole in that order. When I went back to re-check 10 meters it still was fine, with an SWR of less than 2:1 at the frequencies I was testing.

One word of warning—this antenna is one of the more spectacular sights to non-ham neighbors so be prepared to explain it without getting too technical!

How Did the Old-Timers Build Them?

Today, for the most part, hams use coax cable and either attach the shield and center conductor directly to the dipole elements or use a device called a balun. A balun (BALanced-to-UNbalanced) is a device which allows us to connect a balanced device such as a dipole (it has two absolutely identical sides) to a feedline, such as coax cable. Coax cable is "unbalanced."

One way to look at this is to suppose that you suspended a length of coax an inch above a large flat metal sheet. Now if you measured an electric property (such as capacitance) of the shield of the coax to the metal sheet, and then repeated the measurement from the center conductor of the coax to the metal sheet, you would get two different values.

However, suppose you took a length of open-wire feedline—which consists of two identical pieces of wire side by side and spaced by an insulator an inch or two wide—and also suspended this feedline over the metal plate. If you now measured the same electrical property of each side (each conductor) to the metal plate you would get the same readings. The open-wire feedline is said to be "balanced" to ground.

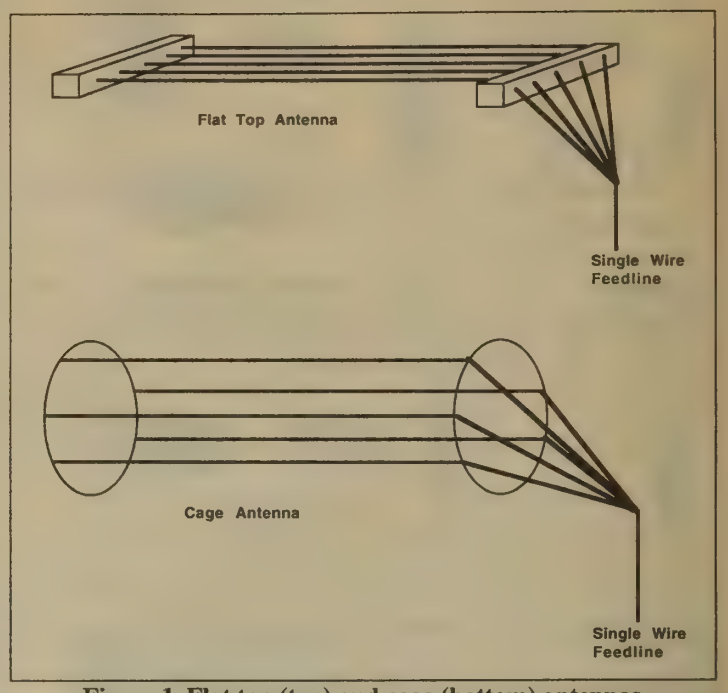

Figure 1. Flat top (top) and cage (bottom) antennas.

Today many hams argue and argue whether or not a balun is really necessary for antennas in the 160 meter to 10 meter bands. The old-timers never had these discussions—they did not have coax—and they had to build their own open-wire feeders.

One trick they did use was to connect a 100k ohm resistor across the dipole feed point, as shown in Figure 6. The 100k value is too high to affect the antenna in any way. But if you think something is wrong with the dipole feedline all you have to do is measure the DC resistance with an ohmmeter at the end of the feedline in the shack. If the coax is shorted you will read less than 100k ohms, and if the feedline is open you will read more than 100k ohms. Thus, you have an instant check on the feedline without having to lower the antenna.

Mail Order Antennas

For a long time, and probably as recently as the late 1950s, Sears and Roebuck was the largest supplier of wire for ham antennas. Their catalog used to list rolls of several thousand feet of coated steel wire for electric fences, at a price of just a few dollars. I suspect that more than a few Sears employees wondered why people in large cities were ordering wire which was designed to keep cattle fenced in!

Today we have a better (although more expensive) antenna wire. Commonly called "Copperweld" (see Figure 7), it consists of a steel core coated with copper on the outside. The steel keeps the antenna from stretching in length, and the copper keeps the steel from rusting and improves conductivity. Although several other types of wire can be used for ham antennas, copperweld offers a long life at a reasonable cost.

The penalty for using copperweld is that it bites. When you unfasten the roll to measure out a length, it jumps out, nips at you, coils, snarls, and in general makes you sorry that you started the project—especially if you are alone.

The solution is to have someone help you carefully unroll the length you need and help hold both ends down as you cut the wire to size and fasten its ends.

The steel makes the wire very springy and you don't want it to kink and break

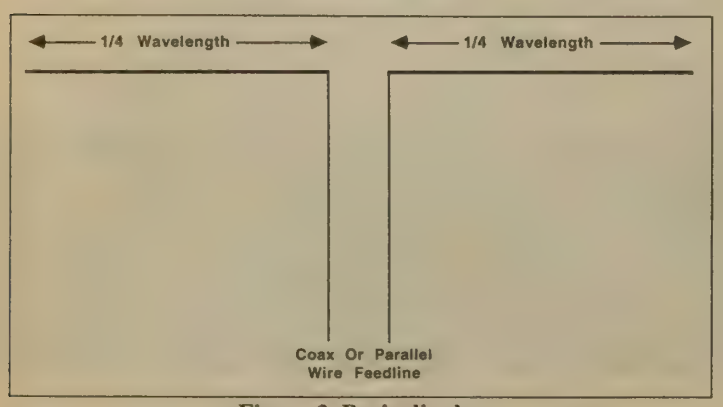

Figure 2. Basic dipole.

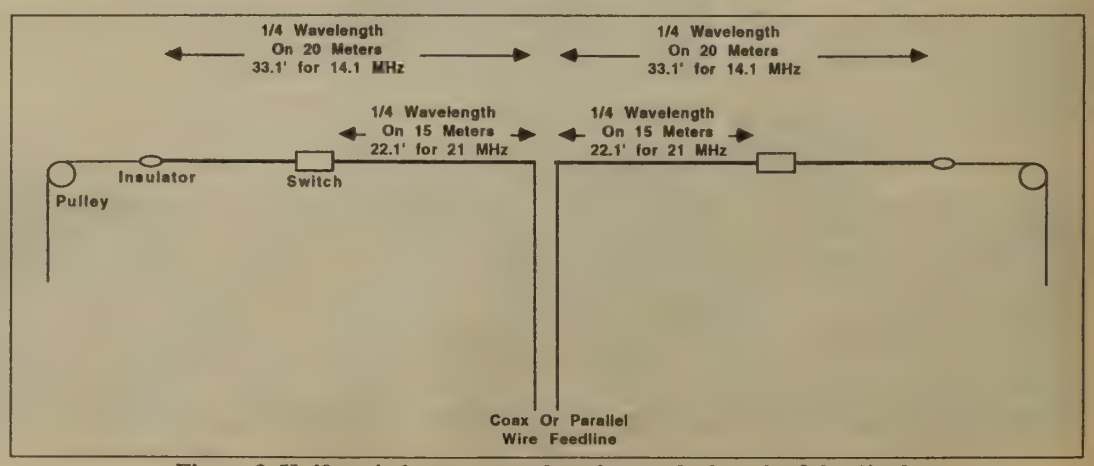

Figure 3. Knife switches were used to change the length of the dipole.

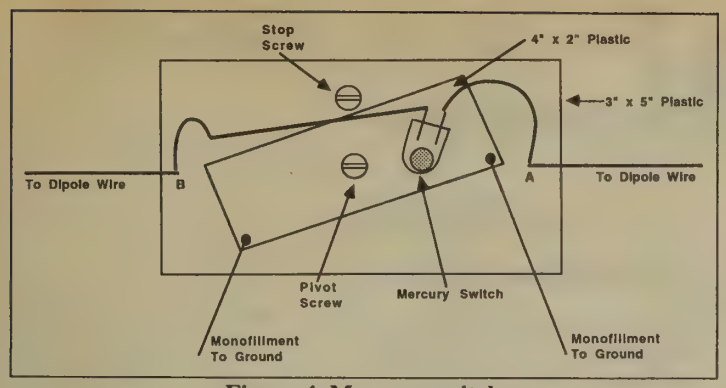

Figure 4. Mercury switch.

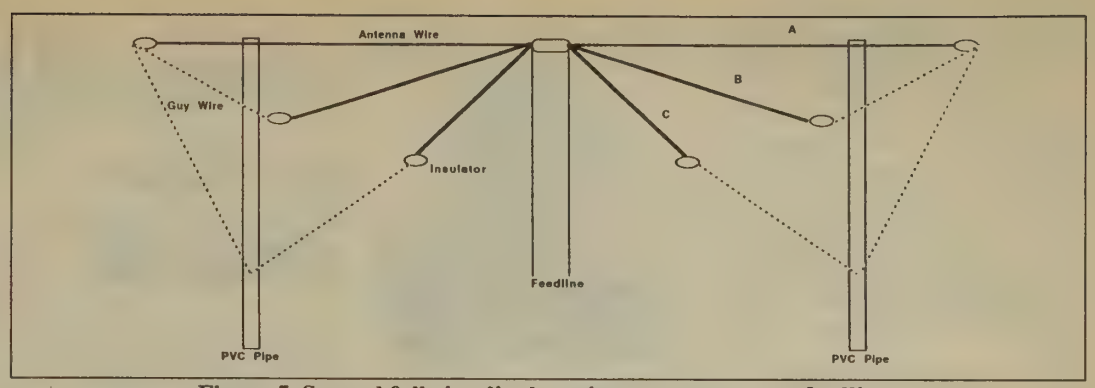

Figure 5. Several full-size dipoles using a common coax feedline.

the copper coating. If the copper is broken, this becomes a point where corrosion can take hold and eventually the steel will rust through.

When you cut the wire for any dipole, keep in mind that the formula is approximate, and if you use it you should allow some extra wire. It's a good idea to leave an extra 18 or 24 inches on each dipole leg, send the wire through the hole in the end insulator, and loosely wind the extra wire back around the dipole side.

After you test the antenna for the first time and the length seems correct, then you can cut some of the spare wire off and permanently fasten the ends.

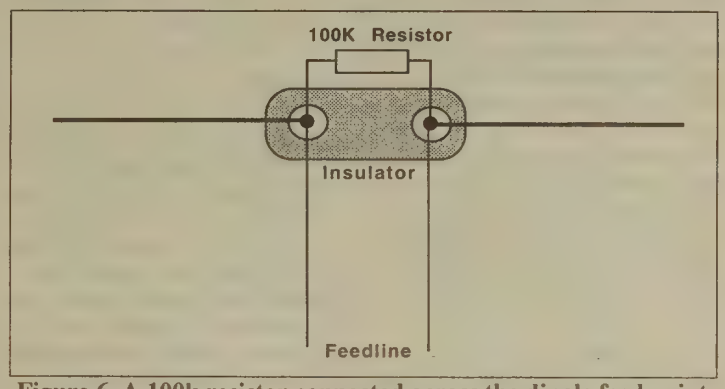

Figure 6. A 100k resistor connected across the dipole feed point.

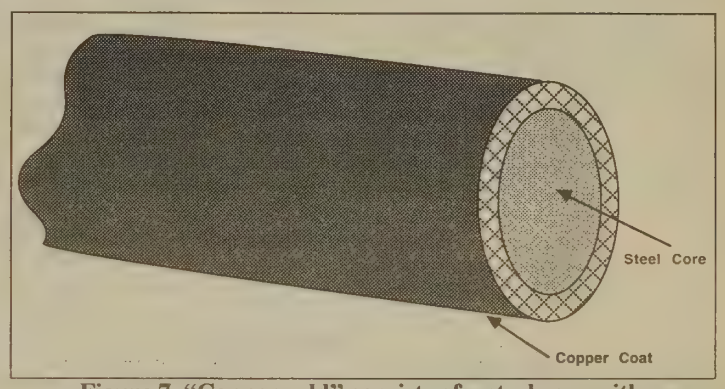

Figure 7. "Copperweld" consists of a steel core with copper coating on the outside.

Old-Fashioned Guy Wire

I don't know when the multi-strand, twisted steel galvanized guy wire we use today first appeared and became available to hams. However, in a pre-1940 book I saw a discussion of the "right" way to connect guy wire.

Today, due to the wide use of TV antennas, most hardware stores, Radio Shack, and supply houses sell U-clips to fasten guy wire. They also sell thimbles or sleeves to place on the wire if it makes a sharp bend around a structure. However, the old-timers did not have the luxury of these devices.

To protect the guy wire as it bent around an insulator or an eye bolt, they would untwist a length of guy wire and cut off a single strand about 15" long. Then they would wind it around the guy wire to be protected in the area that came in contact with the insulator or eye bolt. Thus, the additional wound strand formed a protective shell around the guy wire under tension.

Instead of U-clips to fasten the ends of the guy wire, they would use a strand-by-strand wrapping technique:

First, the guy wire would be threaded through the hole in the insulator, eye bolt, or whatever object it was being fastened to. Then about 14" to 16" of guy wire would be pulled past the hole in the insulator and unwound, so they ended up with 14" or 16" of individual strands at the end.

Next, one strand was wound around both the original guy wire and the remaining untwisted guy wire strands. A second strand would be wound around the bundled guy wire and untwisted strands, followed by the third, fourth, and so on until all the strands were used.

This was a very time-consuming process, to say the least, and very tough on the fingers, despite innumerable little gadgets built to aid in the winding. However, when the tension was applied to the guy wire, it tightened up at the terminated end rather than being pulled loose.

The More It Changes, the More It Remains the Same

As far back as there was ham radio, there were endless discussions on antennas—how to build them, how to match them, and how to use them. Ham radio has changed quite a bit since those days. The materials we have available to us have changed, and our antennas have changed. The only thing that has not changed is our discussions on antennas.

I was not around during the days when some of these antennas and tricks were in vogue. However, I have been fortunate in having seen a number of books used in those days, and even more fortunate in having met and received guidance from hams who started out in the late 1920s and early '30s. Some of these fellows are still with us and active, and they still have a lot to teach us. The designs, tricks, and techniques used in those days still work, and work well. Try a few yourself. RF

computers in the shack

by Jeffrey Sloman N1EWO

Fun on 10 Meters

If you are not using your HF digital privileges on 10 meters, you are missing out on a world of fun—literally. I know you have heard that 10 meters is a dead band—sunspots and all that. You've probably tuned around on 10 only to hear a few weak signals, if anything at all. Well, guess what? A few weak signals is all you need to make some new friends and work some new countries.

Getting Started

The first thing you'll need to get started is a Novice ticket (or a Technician ticket with the code element). This license gives you access to a small portion of the 10 meter band for digital operations. The segment from 28.100 to 28.300 is available for any digital mode authorized by part 97 (the FCC regulations that govern the Amateur Radio Service.) The only limitation is the data rate—how fast information is transmitted, which is limited to a "symbol rate"of 1200 baud. This is actually faster than what is allowed elsewhere in the HF bands.

You'll also need the hardware. A decent antenna, an HF transceiver capable of operation on SSB (Single SideBand) in the digital portion of 10 meters, and a multimode controller or TNC. The multimode controller will allow you to operate in a variety of modes. The TNC is only good for packet and must have HF capability. Even if you only have a TNC, there is plenty to do.

Making Connections

If you own a modern HF transceiver, you can probably connect your controller or TNC to an accessory connector found on the back of these radios. This connector provides access to audio input, audio output, and PTT (Push-To-Talk) circuits. This method of connection has some advantages over the other choice of connection to the speaker output and microphone connector.

First, the audio output from the accessory connector is unaffected by the setting of the volume control. This is much more convenient, allowing adjustment of the listening volume to the choice of the listener without regard to the needs of the controller. It also eliminates the rat's nest of wiring that can result when you must split the speaker output to both the controller and an external speaker. The other advantage is that the accessory connector is for audio input. This path into the radio avoids the circuitry intended for a microphone that the signal will encounter on its way in from the connector on the front.

Making the connection between the components of a digital station can sometimes prove very frustrating. More than one ham of my acquaintance has given up in frustration without ever successfully placing a station on the air. The equipment is either placed on the shelf, or sold to some other "sucker" to wrestle with. (If you don't mind being something of a ghoul, this is a great source for a cheap controller in "unused" condition). In order to avoid this pitfall yourself, take a realistic approach to the problem: Read the instructions in the manual until you are sure you understand them at least a little bit.

Don't expect to understand them completely, either the installation or operation instructions. Just get an idea of what to expect, and make a list of questions about points you don't understand. If you don't get some things, don't fret—this is something new. You are not being dense. You might even be able to blame it on the manual—they are often not very lucid, particularly for the beginner. Give yourself enough time to get the job done. Be realistic about it.

Because ham radio is a hobby it is often relegated to weekends and evenings. This means it may be a couple of weeks between the time you start this project and when you are finished. This is OK! I know that you want it now, but sometimes the choice is either wait or you won't get it at all. Also keep in mind that this work—learning about and connecting together equipment—is a real part of your chosen hobby, ham radio. Don't be afraid to get help!

The "elmer" is an old and respected tradition in ham radio. An elmer is someone who helps you get your ticket, but it also extends to helping with new operating modes. A teacher is ALWAYS important when learning new things. There is no substitute for experience. Find someone locally who has done this before, and let them help you get connected. Then, when you get the chance, HELP SOMEONE ELSE—just as you were helped.

With the right attitude, and a little friendly help, you'll be up and running in no time. You'll also know a bunch of new things, and have a nice addition to your station.

On the Air

OK, so you're connected and chomping at the bit to get on the air. Great! But once again, let's take a little time to learn before we leap. Keep in mind that you now have a station whose PTT line is under the control of a box that could transmit all kinds of stuff if you don't know what you are doing. Most of the manuals you will receive with the equipment will discuss operating in the modes which these boxes can do. Read about them and what to expect, then go on the air.

To get you interested and started, here are some operating modes, frequencies, comments:

AMTOR

This stands for AMateur Teleprinting Over Radio and is a very interesting mode. AMTOR is an error-detecting and correcting mode like packet, but it is older and was designed for poor signals like those on HF. AMTOR has two modes—FEC and ARQ. FEC—Forward Error Correction—mode sends redundant data along with the transmission to allow the receiving station to reconstruct parts of the message that might get damaged in transit. While this error correction technique is not perfect, it works surprisingly well, allowing low error rate transmissions even under poor conditions. This technique is used to transmit traffic lists and weather reports to ships at sea. Amateurs use it mostly for calling CQ, but also for bulletins and round-table discussions.

The other mode—ARQ—is a much more bulletproof circuit. ARQ means Automatic ReQuest to send. This refers to the error correction technique which asks for a retransmission when errors are detected. This is the same technique used by packet, but with AMTOR the packets are tiny—three characters at a time. This makes AMTOR well-suited to noisy channels like HF. Another difference between AMTOR and packet is how a station is identified. While a packet station is identified with your amateur callsign, AMTOR uses a four- or seven-letter code called a "selcal"—for SELective CALling.

An amateur station's selcal is not its callsign but it is derived from the call. For example, my selcals are NEWO and V1EMOOO. Why are there two? Because the older, four-letter codes did not provide enough possibilities. These codes must be unique to prevent "collisions" on the air. How do you get a selcal? Fortunately, your controller will take care of that for you. You supply your call; the controller converts it.

An AMTOR QSO works like this: First I send a CQ message using FEC mode:

CQ CQ CQ DE N1EWO (NEWO, V1EMOOO)

CQ CQ CQ DE N1EWO (NEWO, V1EMOOO)

CQ CQ CQ DE N1EWO (NEWO, V1EMOOO)

This is heard by WA3ELA in Santa Barbara. He decides to call me so he puts my selcal—either the four- or seven-character version—into his controller, which initiates a connection. This part is very much like packet. My controller hears the selcal and a "link" is set up by the two controllers. Once the link is established, the QSO looks pretty much like any other. The only other thing you need to know is how to pass control back to the other station.

In an AMTOR link, a station can be either an ISS (Information Sending Station) or an IRS (Information Receiving Station.) These are just as they sound: the sender and receiver. In our example, WA3ELA initiated the link so he starts out as ISS. His first transmission might look like this:

N1EWO DE WA3ELA/6 NAME IS HUGH, QTH IS SANTA BARBARA, CA BTU +?

The tricky part is the "+?"at the very end. This is an instruction to my controller to "switch over" and become the sending station. BTU is shorthand for "Back To You." That is basically it for AMTOR. Remember that practice makes perfect.

Where to Look

On 10 meters call CQ on 28.125 MHz and you will find a QSO if you are just a little persistent. Try late morning or early evening. You can also try leaving your station on this frequency during the day and see what it has heard when you get home.

Packet: There is a bunch of packet activity on 10 meters. From my southern Indiana QTH, I can regularly work BBSs in California, Mexico, Brazil, and elsewhere in South America. You will find Activity in the lower portion of the digital subband—tuning around slowly will turn it up. Give 28.103 and 28.109 a try; there are quite a few stations there. HF packet is not much different from VHF packet, so you will find your experience there very helpful.

Baudot: Also called RTTY, Baudot is the mode least suited to HF operations. It has no error correction and so requires a good signal for decent copy. None the less, you will find Baudot on 10 meters. If you are interested in working this mode, find an elmer. It is not difficult to operate, but tuning and determining what you are listening to require experience.

PACTOR: This new mode offers the good points of packet and AMTOR combined (hence the name). This is an exciting mode that works well even in very bad conditions. Right now, the hardware for PACTOR is unusual. As PACTOR matures, I will discuss it here.

Conclusion

I expect to hear some of you on the air soon. Propagation here in Indiana has been mostly to the west, so those of you in Oregon, Arizona, and California give me a call as selcal NEWO on 28.125—you might just find me there. Write to me and let me know about your problems and successes, either at P.O. Box 636, Franklin IN 46131, or (preferably) at jsloman@bix.com on the Internet. RF

Joe Carr K4IPV

antennas, etc.

by Joseph J. Carr K4IPV

Getting the Antenna Wire into the House

Okay, so you're planning to install a new antenna. Have you considered everything? Of course you considered how to bring the transmission line into the building, right? I hope so, because you can do a lot of work that doesn't need to be done, and potentially do a lot of damage to your home, if the job isn't done correctly. For purposes of this article we will restrict the discussion to coaxial cable, which is the kind most commonly used by amateur operators today. Some of the general comments also apply to other forms of antenna transmission line, but would have to be adapted to account for differences in construction.

Let's consider two different forms of dwelling: masonry construction and frame construction. We will also consider a situation where it is forbidden to alter the premises; e.g. where you are renting the property or are a teenager living with BDPs (brain-dead parents).

Masonry construction dwellings consist of two basic forms of material: bricks and cinder blocks. While I am certain that there are other materials, space doesn't permit considering here forms other than the basics that take in most masonry homes. In both cases, the bricks or blocks are piled row upon row and fastened with mortar.

The very first job in making the installation is to plan a bit. Know where the antenna is, where the situation is, and how you will route the cable from one to the other. Also, and this is VERY important, know the locations of utilities—electrical wires, plumbing and gas pipes—inside the walls. You really don't want to drill into these . . . really, you don't want to do it! Find a convenient spot on the inside, free of utilities, where you know the cable can be conveniently routed to the station. Figure out how to find it on the outside of the house. I am lucky because in my basement there is a water pipe to an outside faucet through the wall, and I can use it as a reference datum point to measure the actual site (e.g. "4 feet to the left of, and horizontal with the water faucet on the rear wall").

Figure 1 shows how to pass through such a wall. First, notice that the hole is made in the mortar seam *between* bricks. As a youngster I made the mistake of trying to go through a brick—a very old and therefore, very hard, brick at that—instead of the seam. It took hours! The hole through the brick should be made with a carbide bit and electric drill, or a star drill if you don't have an electric drill available. I tend to use 3/8-inch bits for this application when RG-59/A or RG-58/U coaxial cable is being installed. The idea is to make the hole a bit larger than the cable to allow it to be slipped through the wall. Once through the brick, you can then go through any plywood sheathing or dry wall, if such are used. I don't have either because the top of my basement is above grade by 24 inches or so.

Cinder block is treated the same way most of the time: Go through the mortar between blocks. However, as shown in Figure 3, the cinder block has two hollow chambers. You cannot drill through the *center* of the block, but you can drill through the region either side of center. What I do, usually, is to locate the center of the block, then bisect the distance from the center to one end, and then drill at that point.

Frame and siding houses are even easier to pass through than brick. These houses usually have 2 x 4 or 2 x 6 wooden studding supporting plywood sheathing on the outside and dry wall on the inside. The plywood is also usually covered with some sort of aluminum or vinyl siding. These can be drilled through with ordinary wood bits. I prefer the extra long bits (10-12 inches) because they allow me to go through the entire wall in one operation (see the cautions about utilities above).

So now you have a hole in your wall. How do you keep icky things from crawling through it, or water from getting in? A hidden leak can cause a lot of damage, and it should be avoided at all costs. Concrete patch can be used to patch the holes in mortar joints, but in both mortar and frame houses silicone seal, bathtub caulk and other materials can be used. However, I advise you to inspect it every six months or so to make sure that it does not need renewing.

Electronic distributors who sell a lot of TV antenna or cable accessories sometimes carry a rubber wall sealing plug that is intended for TV-type coax, which is a variant of RG-59. These plugs can be used with either RG-58 or RG-59. They form a grommet to keep the coax from being chaffed on the edges of the hole, and help prevent water migration. After a nasty experience with a local cable TV company, however, I also tend to silicone seal even these grommets . . . just in case.

Finally, make sure that there is a *drip loop* (see Figure 2) in the coax. *Do not bring the cable in from above without the loop.* Water will wick its way into the house when the cable is brought in from above. The drip loop should be about 12 inches below a horizontal line that passes through the entrance site (Figure 2).

Now, as I promised, how about the installation where the landlord or parents or whoever don't want a hole in their house? I faced this in a rooming house in college, and solved it with a situation like Figure 4. Fashion a 1 x 4 section of wood so that it can fit between the movable part of the window and the sill. Lower the movable part down onto the wood, and caulk against the weather. Holes, coaxial through-wall connectors and other fittings can be installed as needed. When you move out, remove the wood piece and clean up the old caulk, and you're done.

A security note is in order: That window is very easy to raise, so burglars can easily get in. I found it easy to nail the window shut, or fasten a small hasp and padlock, and that was acceptable to my landlady in that college boarding house. The details will vary with the design of your own window, but take note of the security problem and take steps to prevent that window from being raised by a DSBG (dirty, smelly, bad guy). RF

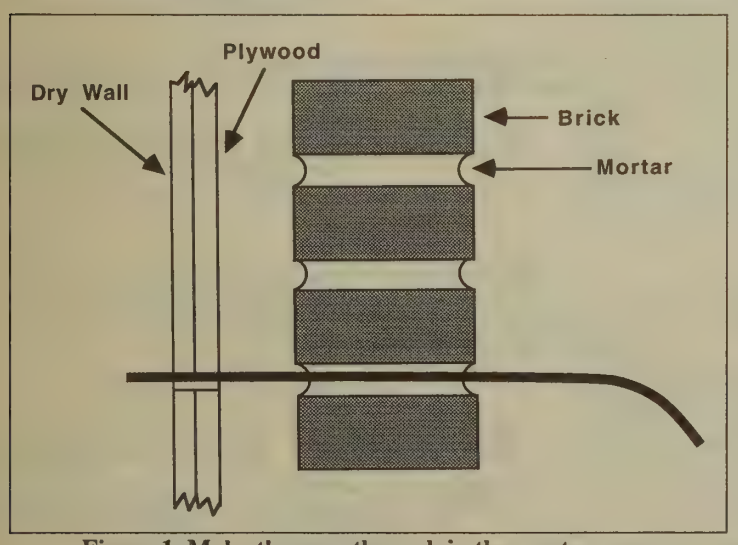

Figure 1. Make the pass-through in the mortar seam between bricks.

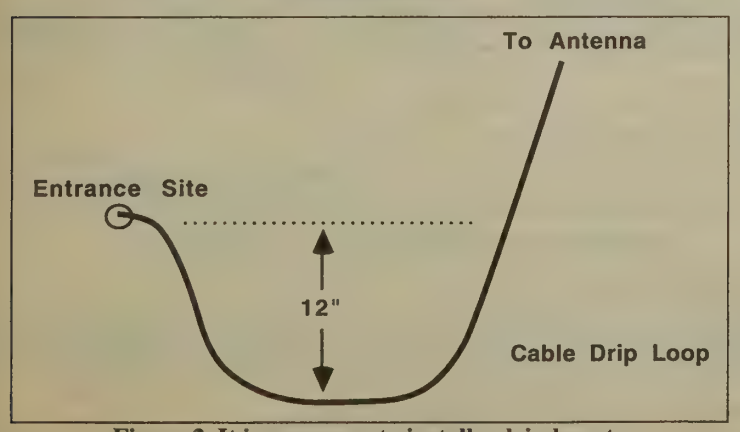

Figure 2. It is necessary to install a drip loop to prevent water damage.

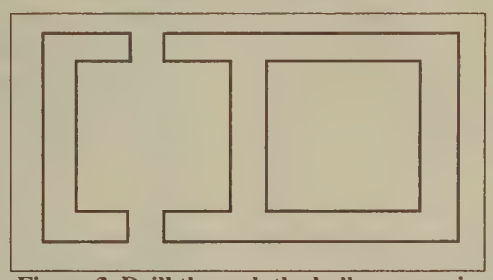

Figure 3. Drill through the hollow space in cinder block.

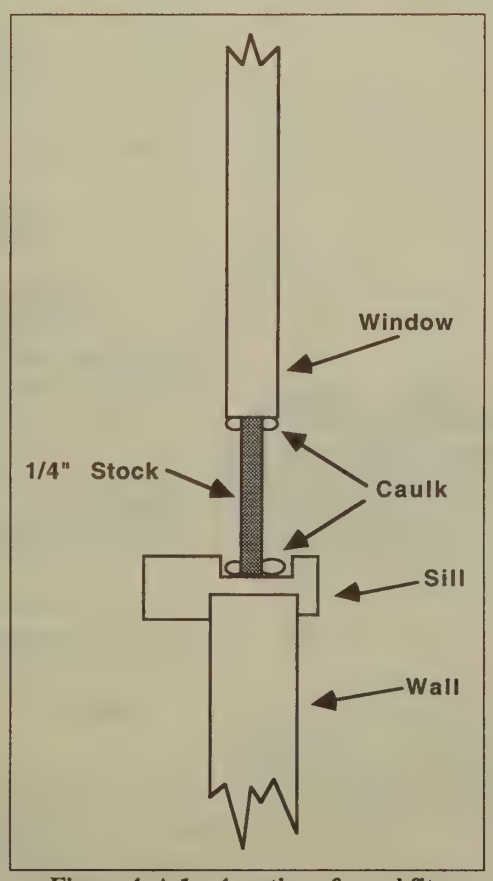

Figure 4. A 1 x 4 section of wood fits between the movable part of a window and the windowsill in places where it is not desirable to put holes in the walls.

Zepp on 2

by Terry Atwood WA5ARJ

This handy little half-wave vertical is simple to make and costs less than $5 to build.

A classic zepp antenna is a quarter-wave stub followed by a half-wave radiator. After seeing the 450 ohm ladderline in use at Field Day to feed the 80 meter loop, I ordered some from The Wireman (1-800-727-WIRE) and UPS delivered it two days later. After I fed my 40 meter loop with the ladderline I had plenty left over.

I had a manufactured J-pole antenna made from TV twinlead and thought that the 450 ohm ladderline would make a great J-pole or a zepp for 2 meters. It took me several hours to cut and trim the ladderline before I could get the SWR to stay on the meter, but finally I came up with the lengths by trial and error.

Construction

A J-pole has the two elements shorted together at the base, and the coax is attached at some point up from the shorting bar. A zepp is not shorted at the base. One element is a quarter wavelength long, and the second element is quarter wavelength *plus* a half wavelength long. Another way to say that is to say you have a half-wavelength antenna fed by a quarter-wavelength matching stub.

However, my problems arose when I tried to use 19" as my quarter-wavelength measurement. Through several hours of trial and error, I learned that the quarter-wavelength measurement should be approximately 16" and the half-wavelength measurement should be 46.5"—the longer element is actually a three-quarter wavelength long and this totals 62.5" for the 450 ohm ladderline.

I attached the ladderline to an SO-239 so I could just screw on my coax from the rig. I can hang it on the window frame, or hoist it up a tree. The gaps in the ladderline make a convenient hanger for a nail or short branch in a tree, or a tie point for nylon rope. RF

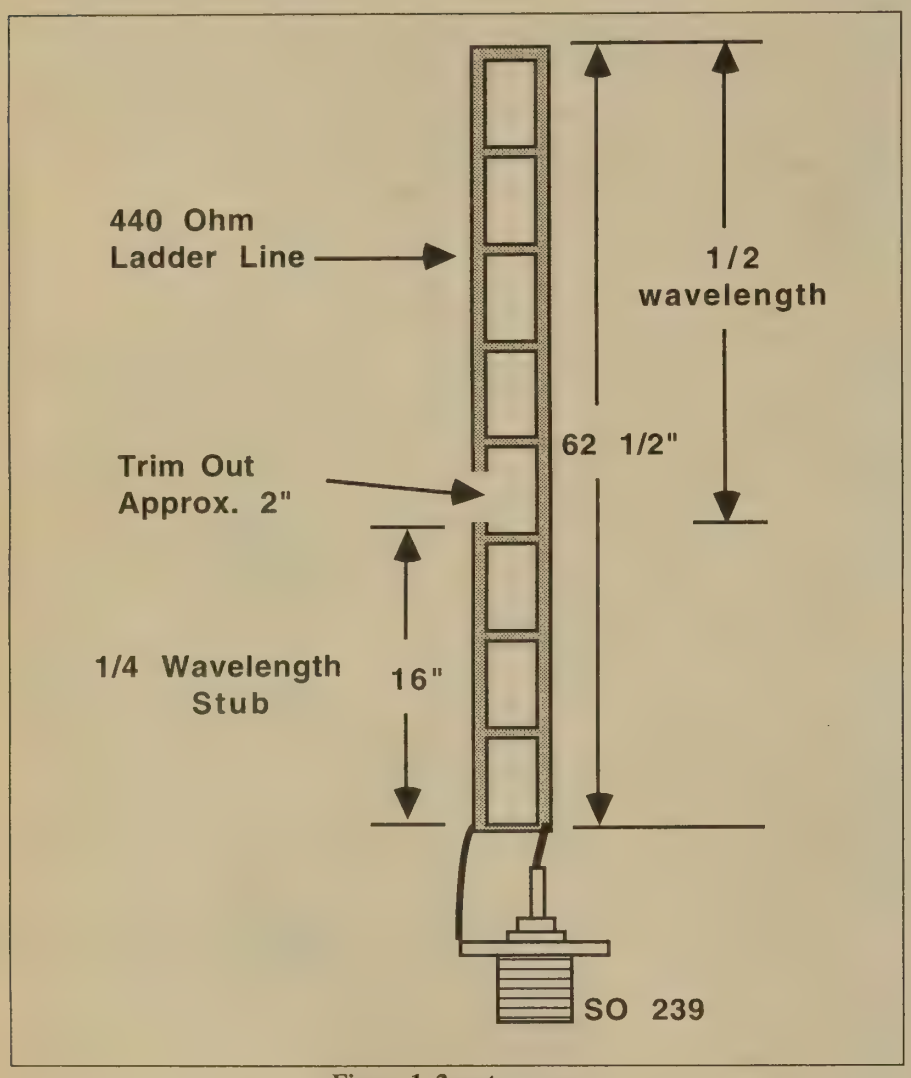

Figure 1. 2 meter zepp.

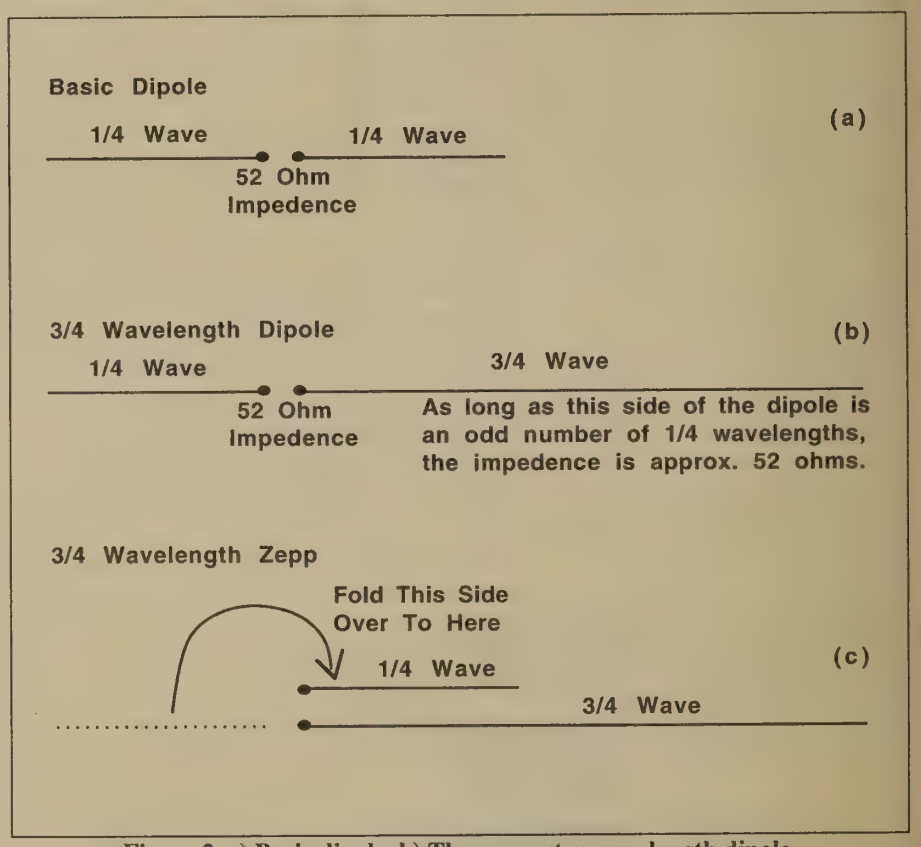

Figure 2. a) Basic dipole. b) Three-quarter-wavelength dipole. c) Three-quarter-wavelength zepp.

Zepp on 2

by Terry Atwood WA5ARJ

This handy little half-wave vertical is simple to make and costs less than $5 to build.

A classic zepp antenna is a quarter-wave stub followed by a half-wave radiator. After seeing the 450 ohm ladderline in use at Field Day to feed the 80 meter loop, I ordered some from The Wireman (1-800-727-WIRE) and UPS delivered it two days later. After I fed my 40 meter loop with the ladderline I had plenty left over.

I had a manufactured J-pole antenna made from TV twinlead and thought that the 450 ohm ladderline would make a great J-pole or a zepp for 2 meters. It took me several hours to cut and trim the ladderline before I could get the SWR to stay on the meter, but finally I came up with the lengths by trial and error.

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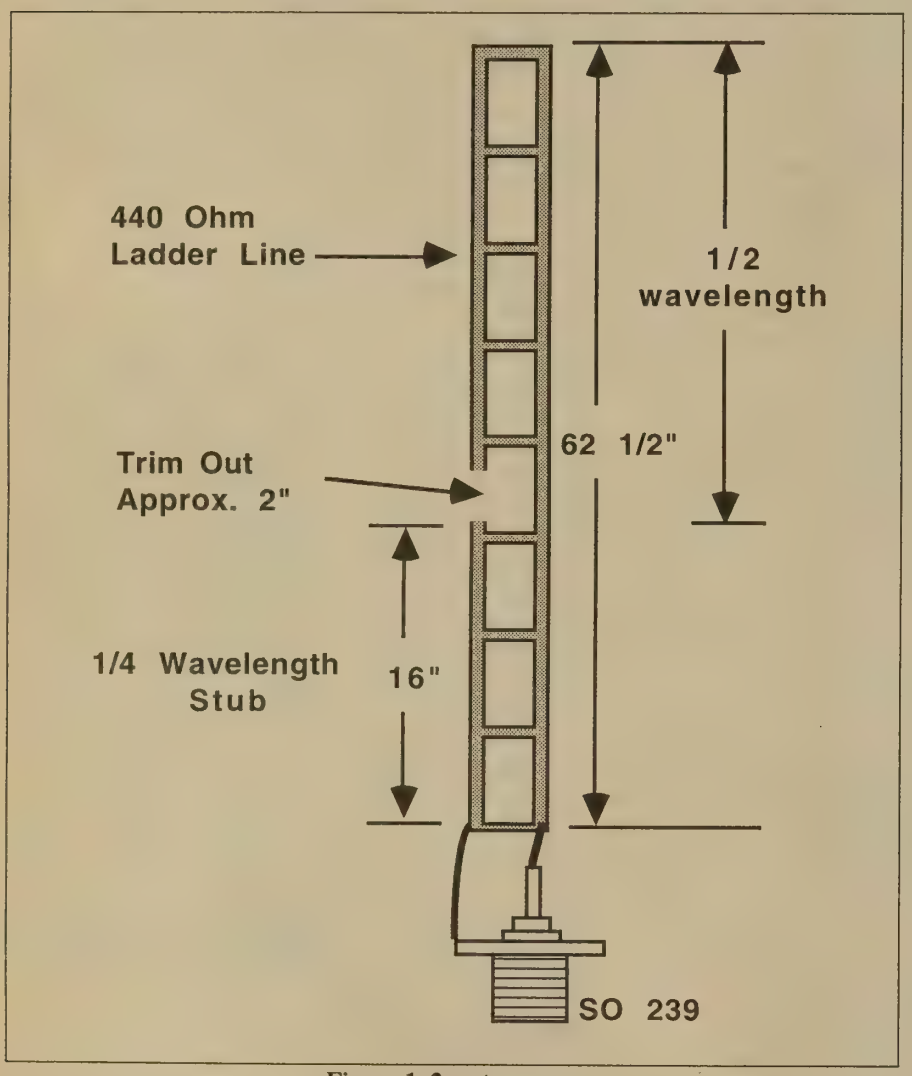

Figure 1. 2 meter zepp.

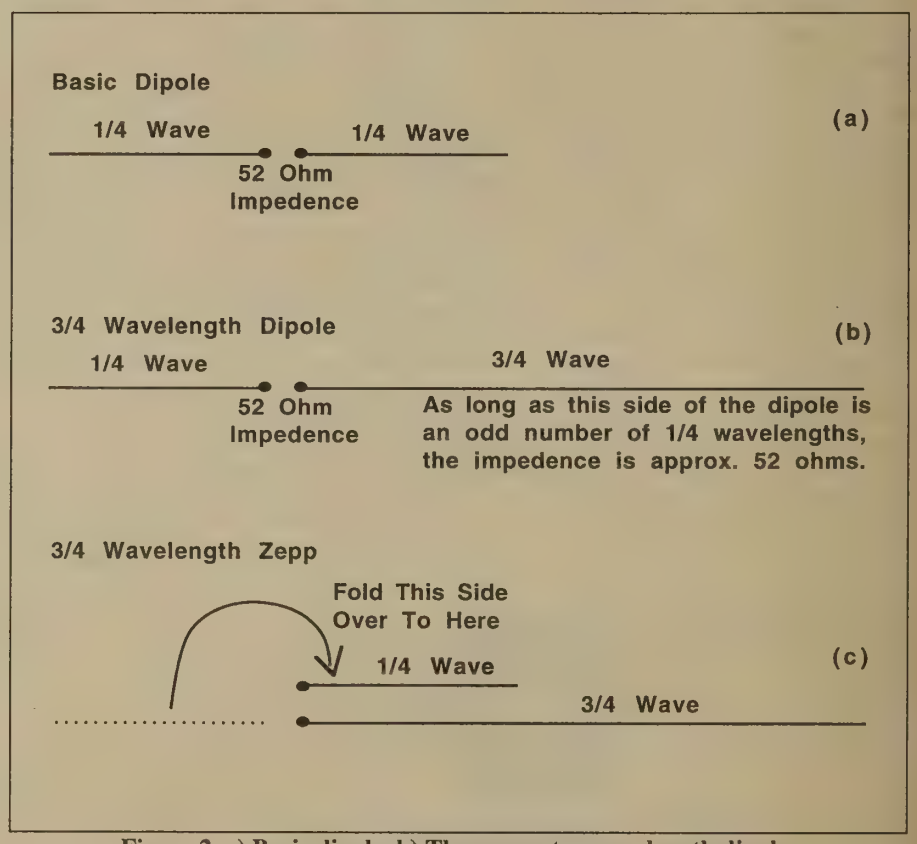

Figure 2. a) Basic dipole. b) Three-quarter-wavelength dipole. c) Three-quarter-wavelength zepp.

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try something new

by Bill Brown WB8ELK

The Ten-Ten International Net

Ten meters has always been one of my favorite bands. You never know just what to expect. There are times when you can talk to the world with just 1 watt of power. Often you can hear stations just a few hundred miles away (short-skip) and sometimes the band is flat dead.

During the peak years, activity rivals that of 15 or 20 meters, with DX rolling in around the clock. However, as the sunspot cycle slows down, propagation begins to deteriorate. At the sunspot low there are long dry spells when the band is dead.

Even during the sunspot doldrums, there can be days when excellent conditions exist on 10 meters. However, there may not be anyone around to work if the band has been dead for a while.

Fortunately, there is a group whose existence is based on stirring up activity on 10 meters and having a whale of a lot of fun in the process. They are called the Ten-Ten International Net, Inc.

The original group was called the Ten-Ten Net of Southern California. It was started in 1962 through the inspiration of Irv Hunter K6PWO. During their first meeting it was decided to hold a net at 10 a.m. local time (1800 UTC). Since everyone would say "See you at 10 on 10," the net became known as the 10-10 net. The purpose of the net was to stir up activity on the band so that the FCC wouldn't think about gobbling up the relatively unused spectrum. As membership grew across the world, they changed the name of the group to Ten-Ten International, Inc.

I first ran across the group in 1970 and received 10-10 number 2280. Now there are over 60,000 members!

How to Join Up

You do have to work a little to join the Ten-Ten group. You will need to contact 10 other members and ask for their 10-10 number. With over 60,000 members, this is not too difficult. Just call "CQ 10-10" and you'll likely start an instant pile-up!

Once you have this list (note the 10-10 number, callsign, name, date and their location), just send it along with the membership dues [$7 ($9 for DX) + $1 new registration] to one of the section managers listed in the sidebar. You will receive a membership certificate and your own personal 10-10 number (see Photo A). In addition, you will receive a quarterly publication called the *10-10 International News*.

Where to Find 10-10 Activity

There are nets every day except Sunday on 28.800 (28.775 on Mondays) and 28.380 MHz (MWFS) starting at 1800 UTC (see the sidebar for the net control list). In addition, there are approximately 200 local chapters that hold nets throughout the week at various times and frequencies.

Ten-Ten International also sponsors four contests each year (called 10-10 QSO parties).

Plenty of Awards and Certificates Available

Once you have your 10-10 number, the real fun begins. If you're into certificates, awards and plaques, you're in for a real treat. Just by collecting 10-10 numbers from each station you contact you can work towards a whole series of awards. You can obtain a BAR (which can be placed on your membership certificate) whenever you collect 100 Ten-Ten numbers. When you achieve 500 contacts, you become a member of the International 500 Club and are assigned an honorary V.P. Number in addition to your original 10-10 number. If you're ambitious enough to make 1,000, 2,500, and 5,000 10-10 contacts, you will receive plaques for your achievement.

In addition, 10-10 offers a Worked All States (see Photo B), Countries Award (for 25 DX 10-10 contacts), Worked All Continents, Worked All Counties, as well as an OM/XYL Award (for working 10 OM/XYL teams).

If this isn't enough for you, most of the local 10-10 chapters offer various awards for contacting certain numbers of their members. Chasing after all these local chapter awards is called "paperchasing" and is a popular activity among many 10-10 members.

You could literally plaster your wall with all of the awards that are available from the over 200 local 10-10 chapters.

Photo A. A Ten-Ten International Net, Inc. certificate (imprinted with callsign and unique number) is issued to every new member.

CQ Ten-Ten

With all this kind of activity going on, you may never find a dead 10 meter band. Tune your rig to 10 meters and give a few "CQ Ten-Ten" calls or check into one of the 10-10 nets. I guarantee you'll be hooked after the ensuing pile-up. RF

Ten-Ten International Nets

All Nets Begin at 1800 UTC

Date	Freq. (MHz)	Net Control
Mon.	28.380	Dusty K6MPN
Mon.	28.800	Lovergne KD6JC
Tues.	28.800	Al W6RNX
Weds.	28.380	Gene W6JGS
Weds.	28.800	Louise N6ELK
Thurs.	28.800	Bill WB6OMH
Fri.	28.380	Dan WV4Y
Fri.	28.800	Sherm K6PTF
Sat.	28.380	Don KA0ZZF
Sat.	28.800	Nat 8P6SA

District Managers

Note: Send your membership application to the manager for the number in your callsign, regardless of where you reside.

1st Call Area	Al Kaiser N1API (10-10 #25468), 194 Glen Hills Rd., Meriden CT 06450
2nd Call Area	Larry Berger WA2SUH (10-10 #407), 9 Nancy Blvd., Merrick NY 11566
3rd Call Area	Chester Gardner N3GZE (10-10 #44119), 9028 Overhill Dr., Ellicott City MD 21042
4th Call Area (FL,KY,NC,SC, TN,VA)	Rick Roberts N4KCC (10-10 #41852), 7106 Ridge Stone Dr., Ooltewah TN 37363-8871
4th Call Area (AL,GA,PR)	Jim Beswick W4YHF (10-10 #11718), 112 Owl Town Farm, Ellijay GA 30540
5th Call Area	Grace Dunlap K5MRU (10-10 #218), From October to June: Box 445, La Feria TX 78559 During June to October: Box 13, Rand CO 80473
6th Call Area	Dick Rauscher W6ANK (10-10 #1931), 4371 Cambria St., Fremont CA 94538
7th Call Area	Willie Madison WB7VZI (10-10 #27856), 10512 W. Butler Dr., Peoria AZ 85345
8th Call Area	John Hugentober N8FU (10-10 #16154), 4441 Andreas Ave., Cincinnati OH 45211
9th Call Area	Jim Williams N9HHU (10-10 #42712), 240 Park Rd., Creve Coeur IL 61611
0 Call Area	Debbie Peterson KF0NV (10-10 #43402), RR #1 Box 35, Duncombe IA 50532
All DX	Carol Hugentober K8DHK (10-10 #29588), 4441 Andreas Ave., Cincinnati OH 45211 USA

Note: To get your 10-10 number, send a list of 10 contacts made with 10-10 members (include their 10-10 number, callsign, operator's name, date of contact and location) along with $7 annual dues (plus a one-time $1 new registration fee) to the section manager for your callsign. The fee for DX stations is $9 annual dues (plus $1 new registration). Family Membership (for members of a family who are 10-10 members in addition to the prime member) is available for an additional $0.50 per family member.

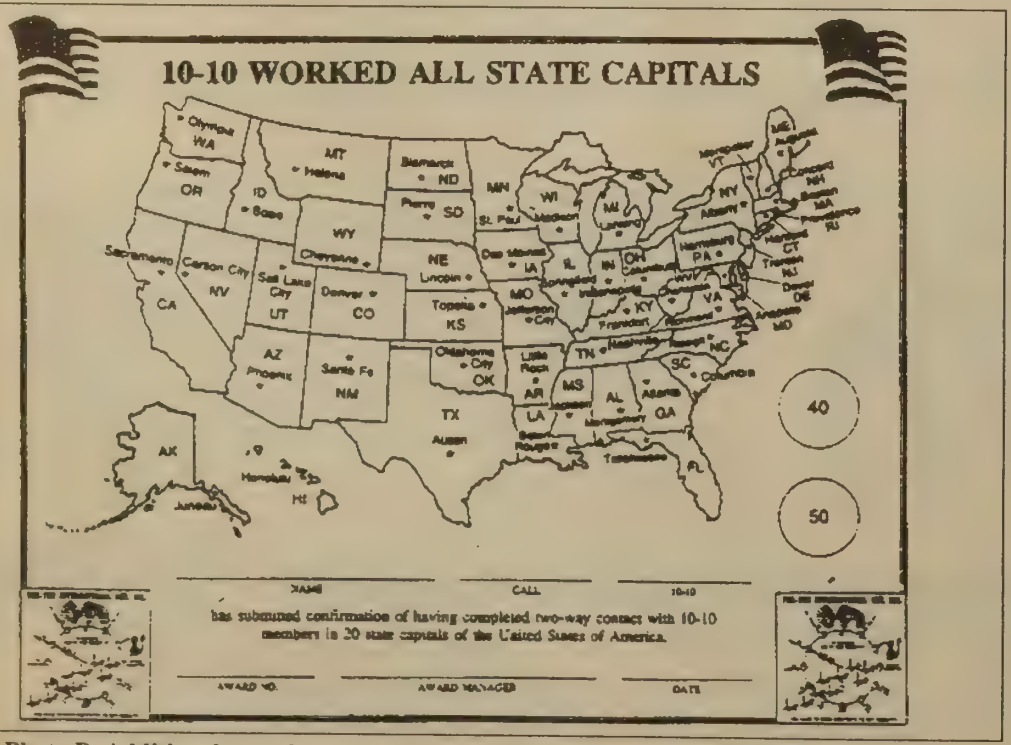


Photo B. Additional awards are available, such as this Worked All States certificate.

Packet Petition

Continued from page 4

rejection of the same by United States amateurs."

(9.) The ARRL Board elected to support a plan which would not permit automatic HF data communications between, or among, themselves. Rather, such stations would be limited to communications with stations under local control. The compromise semi-automatic control was criticized as unworkable and unacceptable by HF packeteers.

(10.) Once again the League's Executive Committee asked the Digital Committee to look into the issue. A meeting was held between the Digital Committee and representatives of the HF packet community in late September 1992.

(11.) A meeting of the IARU Region 2 General Assembly (held in Curacao, Netherlands Antilles) just before the September 26th meeting between the Digital Committee and HF packet enthusiasts produced another—substantially revised—HF band plan—including segments for automatically controlled data communications.

(12.) The new IARU band plan provides segments on each amateur HF band for digital modes including RTTY, AMTOR, packet—defined as including new systems such as Clover and Pactor—but excluding facsimile and SSTV. CW would continue to be permitted throughout all amateur bans.

(13.) The League now recommends that:

(a.) Amateur stations may be operated under automatic control using any accepted protocol for data transmissions within certain small frequency segments;

(b.) Such stations should be equipped with a means to limit transmissions to no more than five minutes in the event of an equipment malfunction or interruption of contact with another station;

(c.) Third party communications may be transmitted under automatic control, using any authorized emission mode [Baudot, AMTOR, ASCII] provided that the retransmitted messages must originate at a station that is being locally or remotely controlled;

(d.) HF data operation should be permitted outside those specified subbands only under local control;

(e.) The rule which prohibits automatic control while transmitting third party traffic (except packet stations using the AX.25 protocol on the 6 meter and shorter wavelength bands) should be changed so as to permit RTTY and other modes under automatic control on HF frequencies as well as at VHF and above.

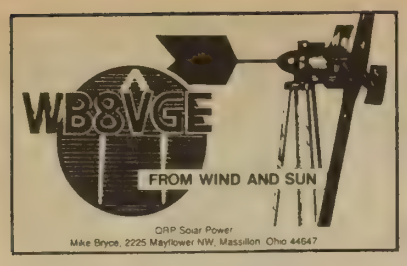
The ARRL recommends the following new Part 97 wording:

Section 97.109 Station Control.

(d.) When a station is being automatically controlled, the control operator need not be at the control point. Only stations transmitting RTTY or data emissions, and stations specifically designated elsewhere in this Part, may be automatically controlled. Automatic control must cease upon modification by an EIC (Engineer-In-Charge) that the station is transmitting improperly or causing harmful interference to other stations. Automatic Control must not be resumed without prior approval of the EIC. RTTY and data stations operating under automatic control on frequencies below 50 MHz must use a digital code permitted in 97.309(a) [Baudot, AMTOR or ASCII] of these Rules, and must incorporate provisions for discontinuing transmitter operation in the event of malfunction, or interruption of communications with another station.

(1.) Stations transmitting RTTY or data may be operated under automatic control in the 6 meter and shorter wavelength bands: 28.120-28.189 MHz; 24.925-24.930 MHz; 21.090-21.100 MHz; 18.105-18.110 MHz; 14.094-14.0995 MHz; 14.1005-14.112 MHz; 10.140-10.150 MHz; 7.100-7.105 MHz; or 3.620-3.635 MHz.

(2.) Stations authorized by these rules to transmit RTTY or data communications under automatic control may transmit third party communications. Any retransmitted messages on behalf of any third party must originate at a station that is under local or remote control. *TNX W5YI Report, Vol. 15, Issue #4, February 15, 1993.* RF



radio magic

by Michael Bryce WB8VGE

Last month we talked about several older but popular PCs for ham radio use. This month we'll look at MS-DOS computers (or, as they are generally known, IBM computers). MS-DOS is the most popular disk operating system used today. Bill Gates of Microsoft made billions with this system. Just about 99.9% of all IBM computers use some version of Microsoft DOS.

In less than a year, IBM changed the entire look of the computer industry with the introduction of their PC. The IBM PC has an open bus, allowing many different companies to "clone" the internal workings of the PC. This opened the market for IBM "clones" and work-alikes. (Perhaps the largest computer company to market clones has been Radio Shack.) Most computer companies making clones don't like the term "clone." They prefer "IBM compatible" instead. Computer companies sprang up all over the place. Dell, Zeoes, Compaq, and a score of others followed. Many of them claimed to be better than the IBM to some degree. Compaq computer boasted that their clones did a far better job for less money. Compaq still makes a very good computer for MS-DOS. Many of the clone computers came from the Asia circle, where cheap labor costs made for inexpensive computers.

With all these clones running around, "big blue" introduced several new models. The last several years have taken its share of companies down the tubes as clone makers go under. IBM took a beating and started to lower their prices on their PC to compete with the clone makers. This made for a buyer's market for PCs. When IBM produced their first PC around 1983, a 64K RAM model with a mono video system would set the user back several grand. Today, that system may be purchased used for under $200 and, if you look around, a new "turbo" version goes for less than $350.

What to Look For

It's no wonder that the IBM-based PC has become the standard in ham radio. There are virtually thousands in use today. For use in ham radio, we must make sure the computer has an RS-232 port, commonly known as "COM1." It would be better if the computer you're looking at supports COM2 and uses a second RS-232 port. (Some will support COM3 and COM4, too, but many software programs will not look for COM3 or COM4.) This will allow you to talk to whatever device you wish, providing it has an RS-232 communication port, and control that device. The many computer-controlled transceivers available need this RS-232 port and the proper software to make a computer-controlled radio possible.

These are some of the highlights of what you'll need to look for, but there are all kinds of things you should be aware of when choosing a computer for your shack. One of these is processor speed. Processor speed depends on several factors. One is the CPU itself; another is the CPU clock frequency. In general, the faster the CPU clock, the faster the computer. Up to a point, that is.

The original PC used an 8080 CPU with a clock speed of 4.77 MHz. Today's PC uses an 80486 CPU with clock frequencies up to 66 MHz! And, the speed just keeps climbing faster with newer CPU chips. Intel will have their "586" on the market very soon, perhaps this year.

Do you need to get the fastest computer in the world for your shack? Not really. If you use your computer for letter writing, simple spread sheets and the like, an 8088 will chug along quite well for you. Even when used with a terminal program, the computer acts approximately like a dumb terminal rather than a computer. All the computing power is normally done by the other equipment, i.e. the multimode controller, and not your PC.

On the other hand, if you use your computer for serious number crunching, such as satellite locating, or you use a large data base, then yes, a faster computer would be a good idea. Today, with the price of PCs dropping all the time, a minimum system would include an 80386 CPU running at 16 or, better still, 25 MHz. This 386 SX system would be hard to beat at today's prices. Next up would be a 486 SX running at 25 MHz. If you're really a speed freak, then go all the way with a 486 DX running at 66 MHz! But remember, with computers, speed is expensive!

Just a few years ago, a computer with 48K of RAM was considered a real powerhouse. Today, that's just not true. In most cases, you'll need at least 640K of RAM using an 8080 or 8088 CPU. The newer CPU chips will access much greater amounts of RAM than 640K. The newer DOS (Disk Operating System) will also allow you to use larger amounts of RAM. Most computers using the 386 CPU come with 1 MEG of RAM. Sometimes systems are sold with 2 MEG of RAM. Be sure the computer you're thinking of getting allows you to expand the total amount of RAM. In most cases, you should be able to expand your RAM to at least 12 MEG. This not only allows you to run larger programs, but it can actually allow the computer to operate faster.

As with RAM, the price of hard drives continues to fall and the capacity to rise. In the past, it was not unusual to pay three or four times the purchase price of a computer just for a hard drive. An IBM XT came with a 10 MEG hard drive. Today, depending on the machine, hard drives are common in the 80 to 270 MEG size. Only the newer versions of DOS will support such large drives as a single drive. The older DOS version requires you to break up the larger drives into smaller logical drives.

Check to see how many floppy drives the computer comes with. It's normal to see only one 3.5" high-capacity drive today. That's fine if you're just starting out, but if you have a lot of old software on 5.25" disks, you need a drive that will read these, too. Find out if the computer will handle two or more drives in its bay.

Check the power supply rating when looking to add on more drives. Some of the cheaper computers just don't have enough reserve power to operate all the extra drives and other cards you may have in your system without cooking the power supply. The more computing power you have, the greater the need for a husky power supply. The most common size power supply for a 386 SX computer is a 200 watt unit.

As for video, get the best you can afford. There is nothing worse than spending a lot of money on a computer only to have a lousy monitor. In the past a CGA, or color graphic adapter, was the standard. Today, VGA is the standard. Look carefully at the monitor. You may hear the salesperson talk about what is known as dot pitch. The monitor may have a dot pitch of 0.48. The smaller the dot pitch, the better the monitor. I'd pay the extra and go with a monitor with a dot pitch of 0.28. Your eyes will thank you down the road.

Ham Applications for Your Computer

OK then, after you buy this new toy, what can you do with it? I asked the same question years ago when I got my Apple. Today, I use a computer to write these columns, keep track of my QSOs, and even help design circuits.

Since the FCC dropped the rule on keeping a log book, you don't have to keep one. However, every ham I know still does. The computer has made logging super easy. It's a great way to keep track of awards or of countries worked. With the computer, finding all your 10 meter FM contacts from January 1988 to December 1992 is a snap! Try doing the same thing just once using your old paper logs!

Contesters have really increased their scores by using the computer to help them find multipliers. The computers allow for almost instant duping during a contest and, if you have the proper software and gear, they will automatically change bands and log the change into the data base for you. If you chase awards, then you'll need a computer. I think of a computer as a set of tools. I know I can live without one, but why try. Sure, you can build a house with a Swiss army knife, but it's a lot faster and easier with some power tools.

Yes, a computer in your shack makes a lot of sense. From simple CW tutoring to complex OSCAR locating, a computer will make your life simpler in the long run. You can connect to the world using a land-line modem or make AMTOR contacts with a multimode controller. Best of all, if you look for used computer equipment, you'll be surprised how cheaply you can get started.

You'll be surprised when you start using a computer in your shack what you'll be able to do. In fact, the laptop and notebook-sized computers have taken ham radio and computing into the field. Now you can check, dupe and score Field Day results, all before the tower is taken down. What used to take hours to score is now done in a few minutes, and with a lot fewer mistakes. RF

The Third Hand

A workbench necessity.

by Marion D. Kitchens K4GOK

We have all tried it. To measure a battery's voltage you hold the battery in one hand, hold the DMM negative lead in another hand, and hold the positive lead in a third hand. Third hand? Yes, it really is a three-handed operation. Most hams have only two hands! (Those with the required three hands need read no further.) Often the battery is dropped; as a minimum, something slips and you can't make the voltage measurement. Much aggravation can accumulate in short order if you plan on measuring many batteries.

The "Third Hand" described here originated when I had about 20 NiCd batteries undergoing recovery using the recently published NiCd zapper circuit by N7APE (*73 Amateur Radio Today*, September 1992, page 24). It became easier to take the time to make the third hand than to keep fumbling with the DMM leads and batteries. Necessity may really be the mother of invention, if one could really call this an invention. It is pretty simple, after all. The "Third Hand" will make life much easier, even if you are measuring only one or two battery voltages. It is designed to fit AA, C, D, and 9 volt batteries, and can be made from readily available components.

Construction

The drawings show about all that is necessary for building the "Third Hand." You may have to pay careful attention to the dimensions if you intend to use it with D cells because it is a tight fit. Just about any sturdy metal can be used for the metal brackets. I used what I had on hand, as you should. A wooden clothespin is recommended because the plastic ones tend to get brittle with age and break.

Make sure the 4-40 screw heads do not touch in the middle when the "Third Hand" is closed. You may have to recess the heads a bit to accomplish this. Also, make sure that the sheet metal screws do not touch, either. Note that the clothespin spring could be another source of shorting between the two brackets. Remedy any such situation. I slipped heavy heat-shrink tubing over the metal brackets near the pointed contacts. This prevents shorting between a battery positive pole and the battery outer case. This is not a problem with many batteries, but it is for a few battery designs. Heat-shrink tubing was also put on the clothespin handles to hold the wiring in place. Red tubing on one handle and black on the other will help make it easy to readily identify the correct polarity.

See the photographs for a good view of what the assembled Third Hand should look like. Note the way 9 volt batteries are measured.

Conclusion

The "Third Hand" has been a real effort-saver at this QTH, and I believe it will be at yours, too. It is in constant use on my work bench. Why not invest a penny's worth of effort and save a pound of aggravation? Build a "Third Hand"! RF

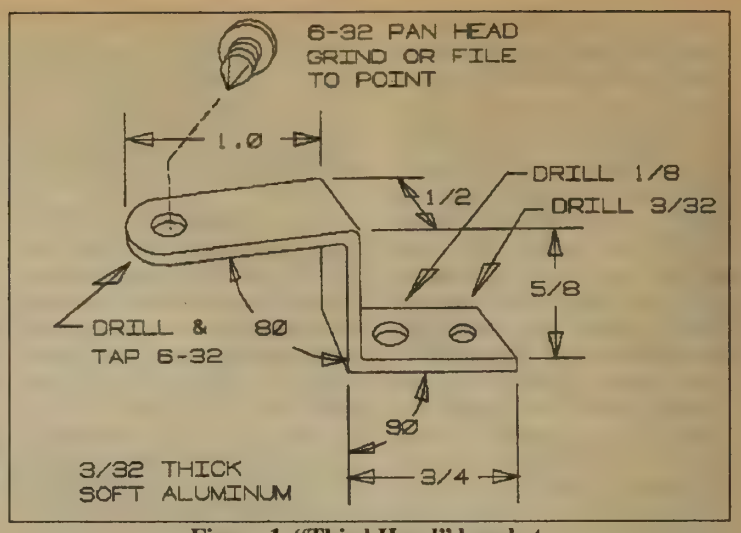


Figure 1. "Third Hand" bracket.

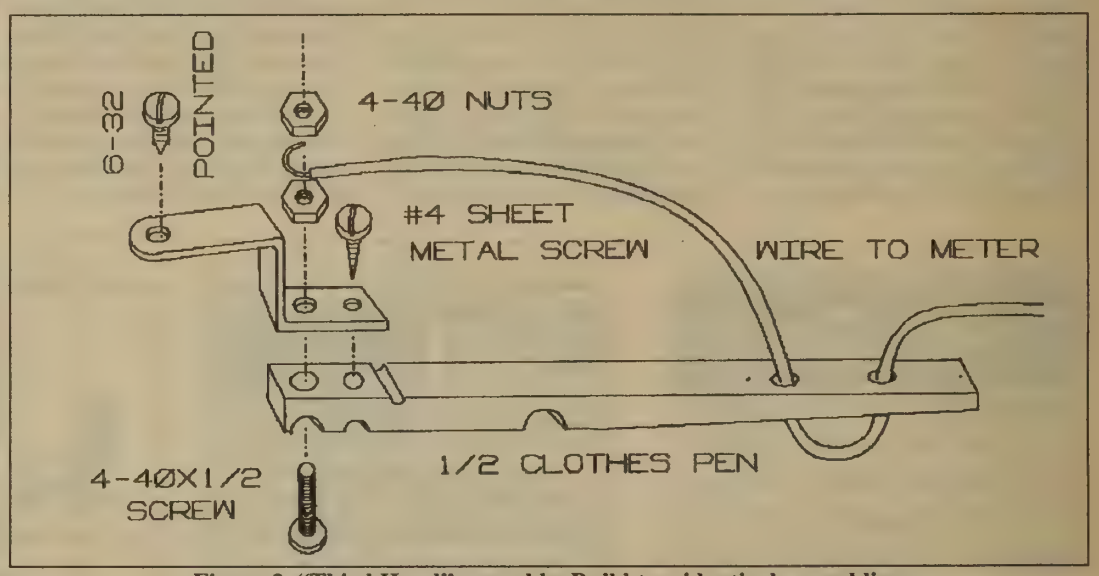


Figure 2. "Third Hand" assembly. Build two identical assemblies.

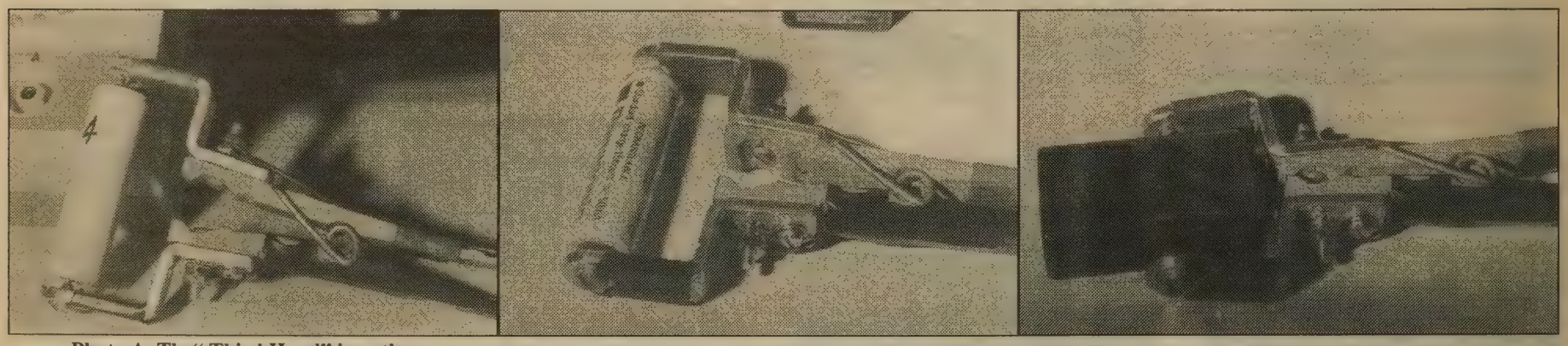


Photo A. The" Third Hand" in action.

the tech side

by Michael Jay Geier KB1UM

RTTY and AMTOR

Last time, we discussed packet radio and all the fun you can have with it. This time, let's look at another mode, called RTTY. Pronounced "ritty," the name stands for radioteletype. This digital mode is quite a bit older than packet. In fact, it goes all the way back to the 1950s! RTTY was developed as a way to send typed material over a long distance. Starting over telephone lines (as TTY), it began to be used over the air as news organizations spread around the world. If you're in your 30s or older, you may remember TV and radio news broadcasts in which a teletype machine clacked away in the background.

Many years ago, the early radioteletype machines began to be replaced with newer models. Consequently, the old machines started turning up as surplus. Naturally, hams grabbed them and began playing with them. By the mid 1960s and 1970s, RTTY was fairly popular, although certainly not anywhere nearly as popular as voice and CW (Morse code).

But then personal computers came on the scene in the early 1980s. Suddenly, you didn't need a huge, clanky old machine to enjoy RTTY. Now you could do it on a nice, clean, quiet PC. The mode's popularity soared. Let's take a look at how digital modes work and what it takes to play with them.

The First Digital Mode

The first digital mode, Morse code, was meant to be decoded by ear, and it does not use a fixed number of bits per character. In fact, the dits and dahs really aren't bits in the same sense as machine bits are, because it is the length of each "bit" that determines what it is. I suppose you could call it a ternary (as opposed to binary) code because it has three states: off, short and long. It works because of the amazing abilities of the human brain to decide many things "on the fly," including which bits are longer than others and when a character is finished, based on the extra space between characters. But, when a machine is going to be doing the decoding, things work much better if each character has the same number of bits and they are binary: ons and offs of equal length. So, virtually all machine codes do it that way. By the way, that's why computerized Morse readers never work as well as a well-trained human; the code just wasn't meant for machines.

Shave and a Haircut . . .

Five bits. RTTY uses a binary (on/off) digital code, just like modern computers do. But, while PCs use an 8-bit code called ASCII (American Standard Code for Information Interchange), pronounced "askee," RTTY uses a much older 5-bit code called Baudot ("bawd-oh"). It is named for the same Baudot from whom the word "baud," as in "1200-baud modem," comes.

The more bits you have in a code, the more symbols you can represent in one code character, because there are more combinations of those bits available. If you only have, say, two bits, there are only four possible combinations you can make: 00, 01, 10 and 11. If you have eight bits, though, you can make 256 combinations. The formula for determining the number of possibilities is simple: the number of possible states for each bit (in this case two, on and off) raised to the power of the number of bits. So, 2 equals 256. Thus, the five-bit Baudot code can represent 32 different symbols. Let's see, we've got 26 letters, 10 numbers and some punctuation . . . nope, not enough bits! The way they got around that was to reserve two codes. One they called "letts" and the other "figs." Before they send any numbers, they send the figs code. Then, they can use the same codes used for letters to represent numbers! When they're finished, they send the letts code, letting the receiving system know that the codes to follow will represent letters again. It works fine as long as the codes are correctly received. If not, though, it can make a mess because the receiving system misinterprets letters as numbers or vice versa.

Tweedle-Dee

To send codes over audio channels, be they telephone wires or radio links, requires turning them into something that resembles audio. The method used for RTTY is similar to that used for low-speed computer modems: The ons and offs are used to toggle two different audio frequencies back and forth. So, an "on" makes one tone and an "off" makes another. The result is a "tweedle"-like sound which can be sent over the radio. The circuits required to decode it back into ons and offs are pretty simple. Let's look at what you need in order to enjoy RTTY operation.

An HF Radio

Although RTTY occasionally used to be heard on VHF, packet has displaced it. These days, essentially all RTTY is done on HF. If you don't have a General class license, you're out of luck as far as transmitting is concerned. Nothing stops you, though, from *receiving* anywhere you want, and hearing all the fun others are having with RTTY just might inspire you to upgrade! Also, there's lots of RTTY used for commercial and news-gathering purposes, and you can tune some of it in. In order to tune the signals, you need a radio capable of receiving SSB or CW signals; an AM-only set won't do it. Also, the radio should be pretty frequency-stable. I've had bad luck trying to do it using consumer-grade shortwave receivers. Some of the better, digitally synthesized ones might be OK, but the old analog-dial kind just isn't good enough. The best thing to use, of course, is a real ham transceiver or a high-grade (we call them "communications grade") receiver.

Hard or Soft?

OK, you've got a signal tuned in. Now, what do you do with it? Just as with packet, there are two basic approaches. The most popular one today is to use a "multimode data controller." This is a box, typically costing around $200, which can work packet, RTTY and related digital modes like AMTOR (which we'll get to later). Hookup is fairly easy: You connect the data controller to the audio inputs and outputs of your radio, and to the serial port on your computer. You boot some included software and you're up and running!

If you've got the cash, this is a nice way to go, because it lets you do lots of different things. There's another way, though. You can build or buy a modem and then let special software do all the other work. Remember, the modem's output (in receive) is a string of ons and offs which represent the Baudot code. Normally, your computer only understands ASCII; Baudot will produce only garbage on your screen. You can get software, though, that converts between the two codes. In fact, I used to have a program for my Apple II+ which didn't even need a modem! This thing read the audio tones in through the cassette port (remember those?) and decoded them into bits and then into characters, all by itself! In transmit, it converted your typing into Baudot and sent it out the game port. It was a bit of work to get it all set up and working properly the first time, but it worked remarkably well. I had many RTTY contacts on 20 meters using that setup. While I'm not aware of such a program for today's computers, there may be some out there, and there certainly is no reason why it can't be done. Heck, today's machines are a lot more powerful than my old Apple.

Kinda Shifty

The difference in frequency between the two audio tones is called the "shift." When receiving RTTY, it's important to know the shift as well as the baud rate. Although some stations use ASCII and 850 Hz shift, most amateur RTTY still is done using old-fashioned Baudot code with a 170 Hz shift. The most common baud rates are 45 and 75 baud, which result in a transmission speed of about 60 words per minute.

In addition to the shift and baud rate, there is also the matter of which tone represents which bit. Once they're converted to audio, the bits are called "mark" and "space" tones. Mark represents a "one" (on) and space represents a "zero" (off). Usually, space is the higher of the two tones. If a station sends it the other way around, it is called "inverted." Data controllers let you switch between the two. Or, you can simply change your receiver from LSB to USB, although you may have to retune it if you do that. Normally, LSB is the correct setting.

Oops, a Misteak

Unlike packet, RTTY has no built-in error correction. Signal distortions caused by noise, fading or interference cause plenty of errors. With a decent signal, you might lose one in 50 or 100 characters. With a marginal signal, you might lose every other one! Unless the signal is really bad, though, you usually can figure out what the sender was trying to say. Using any filtering you might have on your receiver to eliminate extraneous signals and noise really helps.

Over the years, the error problem has frustrated enough people that some have developed newer forms of RTTY. A popular one is called AMTOR (AMateur Teletype Over Radio). In this mode, two characters are sent at a time, along with some error-detecting codes. If the receiving station gets them right, it sends back an acknowledgment code and the next two characters are sent. If not, the same two are sent until they are correctly received. It's kind of like packet, but on a much smaller scale. On the air, it sounds like birds chirping. If you've ever listened around 14.070 MHz on the 20 meter band, you know you can't miss it.

Up until recently, you had to have a data controller to do AMTOR. Now, however, there is at least one program I've seen advertised which will do it in software, with just a RTTY modem.

On The Air

Conversations on RTTY tend to be quite different from those on voice or CW. On voice, people often get tongue-tied and wind up just repeating the weather and what kind of rig they have. On CW, it's such a chore, especially at low speeds, to get much across that similar limitations result. On RTTY, though, there's no mike fright, and many people have become fairly fast typists, thanks to their computers. So, they open up and really converse about a wide range of interesting subjects. Also, some people use "brag tapes," which are pre-typed, stored transmissions detailing the equipment in use and other personal tidbits. Brag tapes (which, by the way, aren't necessarily on tape; it just started that way years ago) can get boring after awhile, but some of them can be a real hoot.

Well, I hope I've inspired you to check RTTY out. Of all the modes I've tried, it is one of the most fun. Typing at someone hundreds of miles away, or watching as two people in opposite corners of the world chat via keyboard, is a blast. Enjoy it! Next time, we'll look at image transmission.

73 from KB1UM. RF

upgrade don't stop now

by Gordon West WB6NOA

How to Work a Hamfest

There is no better place to increase your knowledge and use of amateur radio equipment than at a weekend ham radio convention. These "hamfests" are the ultimate opportunity to talk directly with radio and accessory manufacturers, and to shop for the very best deal from those dealers in attendance. Keep in mind that those dealers want to go home with little or no product left on their shelves.

The weekend ham radio convention may have three different types of exhibitors:

- **Manufacturers** who *don't* sell direct.
- **Dealers** who *do* sell direct.
- A **flea market** comprised of both dealers and used equipment sellers.

Manufacturers

Manufacturers who display at the local weekend hamfest will positively not sell any equipment on display. Manufacturers are there to support their area dealers who regularly stock the equipment plus all of the accessories that go along with it. Manufacturers are there to answer those very technical questions about their equipment and its use. Manufacturers may also bring along their technical staff. This allows you to discuss, in detail, any specific questions you may have about the inner workings of your rig or your accessory equipment.

If you have a nagging problem with your equipment, start out your conversation with a technical staff or service manager in a positive manner. If you begin your discussion with, "Your equipment is a bunch of junk . . . I've had nothing but problems with it . . . Why do they make these things so cheap? . . . ," you're going to start off on the wrong foot with the key person who very well might ultimately resolve your problem with either a repaired unit, a replaced unit or, in worst-case multi-failure times, new equipment at a significant factory discount to replace a piece of equipment that has gone in for the same repair many times before. But this only happens if you start out the conversation in a positive manner.

No, amateur radio manufacturers will rarely sell their display items at the end of the show. In fact, most of the displayed items are non-operational in case they should get swiped from the display shelf—so don't even think of asking the manufacturer to sell you their displayed equipment because it really won't be a good deal after all!

Dealers

Dealers are at the show to sell you product. Certainly they will take time to answer your questions. Many times dealers will have a specific preference for one radio over another. If they ask you how you plan to use your radio equipment, the preference they give you will probably be some great advice from the experts on their staff. However, if you simply go to a dealer and ask for the best price on the "best" handheld, chances are you may end up with a transceiver that might not have all of the features you are really looking for. So it's always a good idea to take your time, look over the selection, then explain to the dealer how you plan to use it. Let them assist you in making your best buying decision.

And chances are, at this two-day ham show, prices may never be lower, especially Sunday afternoon. But don't hold out too long—other prudent buyers realize that some of the best deals always occur right after lunch on Sunday afternoon and they could very well buy the last one in stock. Those low prices are only good during the two-day hamfest.

The Flea Market

The flea market is a good way to find good working used equipment. If an amateur radio operator is selling his or her own gear, they will give you all the facts behind how the unit is operating. If they say it works great, you can bet their callsign's reputation that it will work great at your ham shack. No licensed ham who proudly displays his or her callsign is going to sell you a piece of equipment and misrepresent it as working great when it's really a pile of junk. It just won't happen. They don't want you going on the air to expose their fraud.

However, if an amateur operator tells you that the piece of equipment has had a few bugs, or is a little temperamental, what they're probably really telling you is that this piece of equipment is so messed up it has never worked right, has gone back to the factory numerous times, and the likelihood of it ever working at all is next to zip. Steer clear of anything that is "just a little temperamental."

You may also find amateur dealers out at the flea market, beating the more expensive booth prices on the inside. Double-check that the "dealer" is factory authorized to sell the equipment. If you purchase your equipment from sub-dealers, the warranty might be a problem if you go back to that sub-dealer and expect a replacement for a dead-out-of-the-box set. If you're dealing with a factory-authorized dealer, they usually have an immediate satisfaction program in case you discover that the equipment got internally smashed during shipment and you want to replace it with a new one. If this is the case, you normally need to make your claim within 48 hours. Save your receipt.

More Tips

Cash will many times bring in better bargains at the flea market than any other form of payment. Checks may be worthless at the hamfest unless the retailer has some way of double-checking that your check is good. Same thing with credit cards—unless the seller has some sort of credit card verifying device, they may be hesitant to sell the equipment on plastic. Again, cash usually buys you the best deal.

But it doesn't take any cash to spend some time working with the manufacturers at these hamfests. Manufacturers are specifically there to answer your questions. Manufacturers don't sell their equipment direct.

So take some time with the manufacturers and explore all of the different equipment, and see which one might be best for you. Once you have zeroed in on the brand name and the specific model number, ask that manufacturer which dealer at this show has the equipment in stock. Go over to that dealer, tell them you were sent to them by the manufacturer, and ask what the price is. Check out the pricing with the other dealers, too. Work with a dealer who will give you a replacement unit in case your unit is dead-out-of-the-box within the first 24 hours. And, work with that dealer who has taken the extra step to familiarize you with the equipment and tried to make sure that this is exactly the gear you want to buy.

A hamfest is a great way to get started into getting on the air with the right amateur radio equipment. RF

Photo A. Kenwood, Yaesu and ICOM may have live operating stations at the bigger ham conventions. Be sure to bring your license!

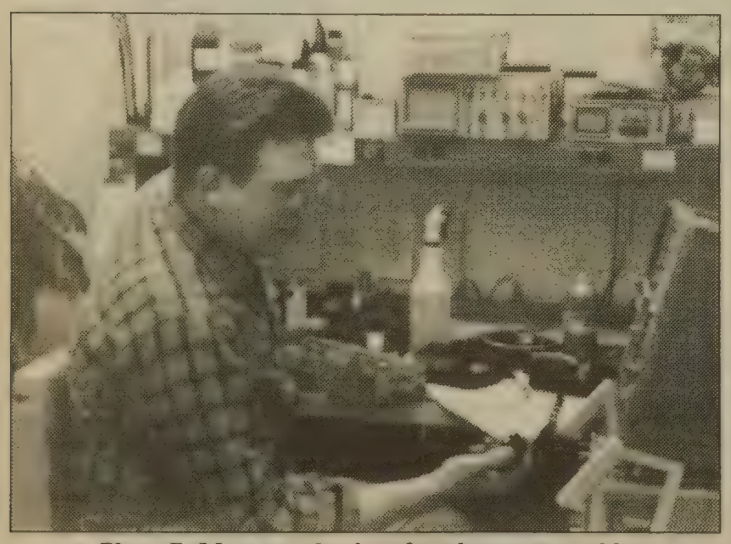


Photo B. Most two-day hamfests have a test table to check out used gear.

Photo C. VEC testing is usually available at big ham radio conventions. You must pre-register to hold a spot.

RF vintage review

The ICOM R70

by Walt Lewandowski WA2VSN

The ICOM R70 is a general-coverage communications receiver covering a frequency range of 100 kHz to 30 MHz. Newly introduced to the market, it made me anxious to review it and share my impressions.

Like most hams, I could not resist the urge to unpack the radio and begin using it immediately without, of course, reading the instruction manual. It is because of this ease of use that I have such good things to say about it.

The IC-R70 has a front panel that is both uncluttered and functional. All controls are clearly marked, and after studying it for a few minutes I became aware of the radio's versatility. Bringing it to life was extremely easy, with just two connections: power cable and antenna. The 117/235-V-AC input is standard, with optional 13.8 V DC available. It is also internally modifiable to 100/200/220 V AC. The built-in speaker eliminated hunting around the shack for the phones or that bullet-riddled speaker that usually turns up.

The receiver is a quad conversion unit with its first IF at 70.4515 MHz. The second IF is at 9.0115 MHz. Without an antenna, I tuned across about all of its range, observing the birdies. The few I found at expected places were, however, far below the level of signals present with the antenna connected.

All of the initial testing took place on the ham bands using my triband beam. Twenty meters provided the kind of signals I was looking for, especially at the lower portion of the phone band. The R70 features a Pass-Band-Tuning (PBT) system allowing you to narrow the width of frequencies passing through the crystal filter. The passband can be moved up to 500 Hz from the upper or lower side in SSB mode (2.7 kHz in the AM mode). With the control in the OFF position, the passband is 2.3 kHz wide in SSB mode and 6 kHz in the AM mode. Using this control, I was able to hear stations that could not be received by using the notch control alone. No information was published as to the shift and depth of the notch filter, but it seems as effective as any other I've used.

While the PBT system took some getting used to, the frequency and mode selection did not. The radio has three selectable-tuning rates: 1 kHz, 100 Hz, and 10 Hz. These controls are located to the right of the tuning knob and, with a little practice, I could quickly zero in on the desired frequency. The one thing that did get a little confusing was the fact that the frequency does not roll over. Increasing from, say, 7.999.9 kHz returned you to 7.000.0 and not on to 8.000.0 kHz. This, however, turned out to be a time-saver when tuning from high to low ends of a band or vice versa. A LOCK push-button is also provided to disable the tuning knob, preventing accidental changes in frequency.

To the left of the tuning knob are three controls marked BAND UP, DOWN, and HAM/GENERAL. These are used to increment or decrement the most significant digit of the frequency display when in the general-coverage mode. When in the ham coverage mode, these controls step you through 160m, 80m, 40m, etc., skipping all of the frequencies in between. It also stops at the new 10, 18, and 15 MHz bands.

Other front-panel controls include CW (wide and narrow—500 Hz), SSB, RTTY, AM, and FM (with the optional module). There is a separate FUNCTION push-button designed to select the sideband opposite the one you are in and to select the narrow CW filter. The receiver automatically chooses upper or lower sideband, depending on whether the frequency is above or below 9 MHz. A SQUELCH control is also provided, obviously getting used more for the FM mode than any other. It did work very well in SSB mode, however, but only on strong

The ICOM R70 receiver.

stations. Its action was dependent on the AGC timing, and in the "slow" setting took quite awhile to open (or close). I cannot see any real need for it except in the FM mode.

The frequency-display panel includes a seven-digit readout with 100 Hz resolution; it displays which mode and VFO is in use. There are two VFOs that can be loaded with the current frequency information and called independently of each other. An RIT control is provided to shift the received frequency +/-800 Hz from the displayed frequency. No indication is given on the display except for a status LED showing that the control is in use. A useful feature is the fact that the RIT control is automatically disabled once the main tuning knob is moved. It can be re-enabled anytime by depressing the push-button. This assures you that you are receiving the displayed frequency.

A built-in preamplifier and attenuator is switch-selectable from the front

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what's next?

by Carole Perry WB2MGP

Photo A. Left to right: Cody Haley KB5WYJ and Casey Haley KB5UEO.

Sneak Preview of Kids at the Texas HamCom

So you're interested in meeting some enthusiastic young people in amateur radio, are you? I've got just the place for you to go. On June 5, 1993, I'll be moderating the Youth Forum at the Texas HamCom in Arlington. There will be some dynamic, accomplished and articulate children doing presentations at this forum on Saturday morning.

It's always a privilege to be able to showcase the achievements of young people. It's especially exciting for me to present these children to an audience who we hope will be comprised of lots and lots of other youngsters. The goals of the youth forums are many.

First, it's a good thing for adults to honor and encourage the children who are actively involved with worthwhile activities such as amateur radio. Second, the non-ham kids in the audience are more easily persuaded by their peers about the fun in our hobby. Third, these forums present a unique opportunity for teachers to get good ideas about what excites young people today, and for recruiters or ham radio instructors to gain insight into why children might be attracted to what our hobby has to offer them.

Casey and Cody Haley

Two brothers who came to my attention from several different sources are Casey and Cody Haley. Eight-year-old Casey KB5UEO was first licensed as a Novice at the tender age of seven. He quickly upgraded to Technician Plus and passed the General theory test before his eighth birthday. His dad, Marty AB5GU, tells me that his son used his Christmas vacation time to study the code, and passed the 20 wpm code test at the Baytown VEC test session right after New Year's.

This South Houston, Texas, youngster shares a radio shack with his dad, Marty, and his mom, Wende KB5TNU. Their station includes a Kenwood TS-940S transceiver with a dipole antenna. Casey's uncle, Barry KI5WE, gave him a 10 meter Yagi-Uda beam antenna, and his dad gave him a 50-foot tower to hold it.

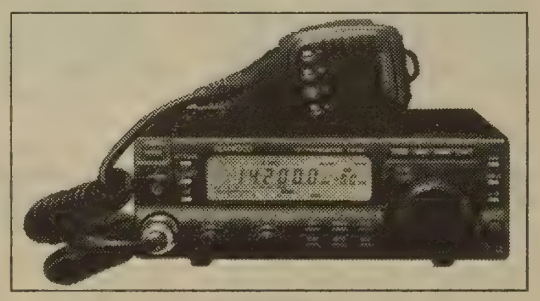
Casey loves contesting, joined the 10-10 club, and recently made 170 contacts in 30 states and 19 foreign countries during a contest weekend. The family has added a computer to the shack so Casey can become more adept at sending and receiving CW at faster speeds, and using packet radio with his mother. He is a straight-A student at Pearl Hall Elementary School, where he attends third grade. Casey is a Cub Scout, a Little League baseball player, and a member of the Gulf Coast Youth Rodeo Association, where his events include riding the bareback ponies and the claves. He also enjoys swimming, roller-skating, and cycling with his nine-year-old brother, Cody.

Cody KB5WYJ is presently a Technician Plus. He enjoys operating on the 2 meter band and speaking with the large number of young hams in the Houston area. The Pearland Amateur Radio Club repeater is busy with after-school QSOs. Cody also enjoys getting on 10 meters after school and rag-chewing with other hams while collecting contacts for his "worked all states."

His proud dad, Marty, tells me that while he, himself, was studying for upgrades, he'd let both boys sit on his lap and read with him. After a few sessions like this, Casey started to answer the questions and soon announced, "I could do that!"

Well, both boys obviously did do that, and have become super role models for other youngsters. Casey and Cody will be introduced at the Dayton Youth Forum in April, and will be featured speakers at my forum at the Texas HamCom. Come join us at these wonderful youth forums and show support for these terrific young people who are the future of amateur radio. RF

new products



KENWOOD

Kenwood has released the world's smallest HF transceiver, the TS-50S. This mobile unit will fit into places you wouldn't think possible. It can be a compact DXpedition unit or an HF to take to the mountains. You can add it to your shack, bring it to the office, or keep it on your nightstand at home. Even though it's remarkably small (6.4 lbs., 7.16" x 2.4" x 9.32"), there's no sacrifice on quality or features: 100 memory channels, 100 watts output (adjustable to 50W or 10W), DDS with innovative "fuzzy" control logic, dual VFOs, wide receiver dynamic range, all-mode (SSB/CW/AM/FM) coverage, general coverage receiver (500 kHz to 30 MHz), automatic gain control (slow/fast), TF-set, IF shift, AIP, all-mode squelch, CW reverse, convenient menu programming, and many other features.

The basic unit is priced at $1,199.95. For more information and prices for the optional accessories (external auto tuner, 500 Hz CW filter, control cable, mounting bracket, etc.), contact *Kenwood U.S.A., P.O. Box 22745, 2201 E. Dominguez St., Long Beach CA 90801-5745.*

THE GRAPEVINE GROUP

The Amiga Troubleshooter by Ian Perry of Wilcom Australia Ltd. is a simple, easy-to-use symptomatic guide to diagnose faulty components (especially ICs) on Amiga A500/A2000 computers. The Amiga Troubleshooter is a diagnostic tool that takes you through logical steps, leading you directly to the source of your problem in seconds. A very high percentage of Amiga problems are readily fixed by simple substitution of integrated circuits (ICs) in existing plug-in sockets. The novice, as well as the experienced technician, will find it simple to use. No other tools or equipment are needed.

The Amiga Troubleshooter is priced at $12.95. For more information, contact *The Grapevine Group Inc., 3 Chestnut Street, Suffern NY 10901; (914)-357-2424, (800) 292-7445, Fax: (914) 357-6243.* Or circle Reader Service No. 201.

ICOM R70 Review

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panel. Claimed attenuation is 20 dB, with no mention of the amount of preamplification. Judging from the S-meter indication, it seems to be in the order of 6 dB. An AGC selector permits a timing of fast or slow, or OFF. This I found more than adequate for all types of communications using the fixed rates. A switchable noise blanker proved very effective in both the available narrow or wide settings. It also seemed very effective with woodpecker-type noise. No decrease in signal levels was perceived with the noise blanker switched in.

The built-in speaker provided good quality reproduction of all types of signals in the AM mode, and SW broadcast stations were very enjoyable to listen to without the high-pitched sound that one might expect from such a small speaker. In any event, an external speaker jack is provided should you wish to use it, as well as a recorder output jack. The latter outputs an audio level independent of the volume-control setting.

Although advertised as a general-coverage communications receiver, rear-panel connectors are provided to allow easy use of the unit with a transmitter or transceiver. The IC-R70 has a mute input allowing it to be quieted during transmit. Transmitted signals can be heard in the receiver, however, by using its monitor function. The volume of the monitored signal can be adjusted with the front-panel control.

The rear-panel accessory socket can also be used to control VHF and UHF converters. The switching arrangement is covered in sufficient detail in the manual. Available on the accessory socket is an output from the receiver's detector stage. This output is at a fixed level, regardless of the volume or gain settings. It is intended to be used to drive a RTTY terminal unit. Other rear-panel connectors include a scope output from the first IF (70.4515 MHz). This would be useful for using a panoramic-type display.

Rear-panel antenna connectors are of both the PL-259 type and spring-clip type. The former is intended for approximately 160 meters and up, while the single-wire input is intended for the AM broadcast band below. The coaxial connector is designed for a 50-ohm impedance antenna system, and no specifications are given for the longwire connector. No provisions are made for antenna matching, leaving it entirely up to the user to determine optimum performance.

My final comments deal with the instruction manual and schematics. As one who likes to maintain his own equipment, I found the documentation included totally lacking in content. The manual is an excellent operating instruction manual, but very little information is given on circuit description, troubleshooting, and general maintenance. The schematics are of the type showing detail of individual circuits, but interconnections are vague.

In summary, I would consider this receiver an excellent value. Its performance would make it suitable for the beginning ham, as a standby receiver for the shack, or to fill the void between hamming and casual listening. Its usefulness for Field Day or emergency communications cannot be overlooked. Also, I don't think the new or seasoned SWL could find fault with its performance—again making it a worthwhile addition to the shack. RF

Reprinted from the February 1983 issue of 73 Amateur Radio's Technical Journal.

Radio Fun flea market

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 30,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 10 cents a word for individual (noncommercial) ads, and 70 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using.

Send your ads and payment to *Radio Fun Flea Market*, Judy Walker, 70 Route 202 N, Peterborough NH 03458, and *get set for the phone calls.*

The Deadline for the May 1993 Flea Market is March 19, 1993.

WANTED-External Power Supply for Palomar 300A Amplifier with 8 wire with 8 pin plug for back of amp. Good shape only. KB9FFB Harold, PO Box 264, Adams WI 53910. RF200

HAM RADIO REPAIR—Prompt service. **ROBERT HALL ELECTRONICS,** 1660 McKee Rd., Suite A, San Jose CA 95116. (408)729-8200. RF210

WANTED: External MAC 40M Drive—Repairable OK. (718) 729-0714. Answering Machine. RF225

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activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458.
We'll print as many as space allows, on a "first come-first listed" basis.

APR 3

AJAX, ONTARIO, CANADA The South Pickering ARC, Inc., and the North Shore ARC, Inc., will sponsor a Flea Market from 9 AM-2 PM at the Pickering High School on Church St. North, Pickering Village, in Ajax. Vendors: To register in advance, contact *South Pickering ARC, Inc., P.O. Box 53, Pickering Ontario, L1V 2R2. Canada.* Make checks payable to the South Pickering ARC, Inc. For info, contact: *Ron Brown VE3WZ, (416) 839-3711; Kim Becker VE3SVZ, (416) 571-6883; Garry Brisbane VE3REP, (416) 683-4335; or Bob Partridge VE3SRD, (416) 839-7585O.*

CHESAPEAKE, VA The 8th annual Chesapeake "SpringFest 93" Amateur Radio/Computer Show will be held at Virginia Beach Pavilion from 8 AM-3 PM. VE Exams by CDXA: Bring original/Copy and ID. Talk-in on 146.970-. Dealers contact: *Preston P. Ipock N4SHI, (804) 543-4610.* Flea-Market contact: *Robert M. Holt N4SFH, (804) 487-1896,* or *Chuck Moseley KD4IJU, (804) 545-1303.* Sponsored by Chesapeake ARS.

NW ROCHESTER, MN The Rochester ARC will hold their annual Hamfest at John Adams Jr. High School, 1525 31st., NW Rochester, starting at 8 AM. Talk-in on 146.82 (W0MXW/R). Write to *Scott Sherratt N6VB, 6982 Indigo Ct., NW Rochester MN 55901.*

WILLIAMSBURG, VA The Williamsburg Area ARC will sponsor ARRL Exams April 3rd. Contact *Andrew Swanson WJ4X, (804) 253-2811.*

APR 3-4

SPOKANE, WA The 16th Annual Inland Empire Hamfest/Computer Show will take place at Spokane Youth Sports Bingo Hall, East 2230 Sprague Ave. Set-up Fri., Apr. 2nd, 12-5 PM. Contact *"Ike" Brown KF7PU, (509) 459-2667.*

APR 4

RALEIGH, NC The Raleigh ARS will present its 21st Hamfest/Computer Fair in the Jim Graham Bldg., NCS Fairgrounds, from 8 AM-4 PM. To pre-register for VE Exams, contact *Vince AA4MY, (919) 847-8512.* Dealers, contact *Rollin Ransom NF4P, 1421 Parks Village Rd., Zebulon NC 27597. Tel. (919) 269-4406.* Talk-in on 04/64.

SOUTHINGTON, CT The 10th annual Fleamarket of the Southington ARA will be held at Southington High School from 9AM-1 PM. Set-up at 7 AM. For details contact *Steve N1GCV, (203) 621-6191.* Talk-in on 146.88, 224.80, 444.25, 145.49. Pre-register for VE Exams by sending an SASE to *Southington ARA, P.O. Box 873, Southington CT 06489.*

APR 10

CLINTON, TN Oak Ridge ARC will hold the "Oak Ridge Hamfest '93" at the National Guard Armory in Clinton, from 8 AM-5 PM. ARRL sanctioned. Talk-in on 146.88, 146.97 (W4SKH). VE Exams by WCARS; contact *Ray Adams N4BAQ, 4325 Felty Dr., Knoxville TN 37918.* Hamfest contact: *Gene Muncy KB4UMM, (615) 435-1588.*

FERGUS FALLS, MN The 6th annual ARRL Affiliated Hamfest sponsored by the Lake Region AC, will be held from 8 AM-3 PM at the Hockey Arena, Otter Tail County Fairgrounds. VE Exams. Set-up at 4 PM on Friday. Contact *Keith McKay N0FKF, (218) 826-6274.*

JOHNSON CITY, TN WCARS/VEC Exams will be held at 10 AM in Room 223, Technology Bldg., ETSU. Contact *Charles Hensley AC4QF, (615) 743-5144 or (615) 926-1171 x7807;* or *C.V. Jayne, Jr. W4NHT. (615) 282-5822.*

MARION, NC VEC Exams by the West Carolina ARS, will be held at 2 PM at the Asheville Federal Bank Bldg., Main St. Please call *Cecil D. Potter WB4UCF, (704) 724-4007,* for details.

MARYVILLE, TN The West Carolina ARS will offer VE Exams at 7 PM at St. Andrews Church Hall, W. Broadway. Please contact *Carroll Peabody W4PCA, (615) 982-5839.*

MEMPHIS, TN VE Exams will be held at 9 AM at Central Church, 6655 Winchester Rd. Sponsored by WCARS. Please call *Win Guin W2GLJ, (901) 754-4552,* or *Nita Wofford N4DON, (901) 363-4971.*

ROANE COUNTY, TN VE Exams sponsored by WCARS, will be held at 10 AM at Pond Grove School, Rockwood. Contact *Richard Spillee AA4KS, (615) 354-4281,* or *Bill Smelcer KA4AAD, (615) 882-9070.*

SOUTHINGTON, CT The Southington ARA will hold its 10th annual Fleamarket at Southington High School from 9 AM-1 PM, at the Southington High School. Set-up at 7 AM. Talk-in on 146.88, 224.80, 444.25, 145.49. Contact *Steve N1GCV, (203) 621-6191.* VE Exams by pre-registration only; send a SASE to *Southington ARA, P.O. Box 873, Southington CT 06489.*

WEST MEMPHIS, AK WCARS VE Exams will be held at 9 AM at Rosewood United Methodist Church, 2303 E. Barton Ave. Contact *Gene Bagley AB5BL, (501) 739-4029,* or *Rev. Richard Gregory AB5CH, (501) 735-4060.*

APR 11

JASPER, TN West Carolina ARS VEC Exams will be conducted in the Jasper Public Library at 1 PM. Please call *Charles Wooten KD4XX, (615) 942-5116,* or *Wallace S. Brown KD4XV, (615) 942-2836.*

APR 15

FENTRESS COUNTY, TN VE Exams by the West Carolina ARS will be held at 7 PM at the First Baptist Church. Call *Mike Ledbetter AB4BX, (615) 879-8626,* or *Fred Davis K8DOC, (615) 879-9268* for details.

APR 17

BOWLING GREEN, KY The National Guard Armory on Hwy. 231, near the Green River Pkwy., will be the location for a Hamfest/Computer Fest sponsored by the Kentucky Colonels ARC, from 7 AM-2 PM. Talk-in on 146.25/.85 rptr. Call *Denver, (502) 777-3681,* or write: *P.O. Box 9781, Bowling Green KY 42102.*

COLUMBIA, SC The West Carolina ARS will offer VEC Exams at the Red Cross Bldg., Bull St., starting at 8:30 AM. For details, call *Ray Rogers N4WR, (803) 345-3373.*

GOOCHLAND, VA The S.M.A.R.T. Swapfest will be held at the Goochland County Fairgrounds beginning at 8 AM. Set-up at 6 AM. VE Exams at 12 noon. Talk-in on 147.27 and 444.800. Contact *Wanda Clemons KD4OCK, (804) 556-4392.*

JOPLIN, MO Joplin ARC Hamfest '93 will be held from 8 AM-3 PM at the John Q. Hammons Trade Center, NE corner of Hwy. 71 and I-44. VE Exams. Talk-in on 147.210+. Call *(417) 623-3610, days,* or *(417) 782-5848 eves;* or write to *J.A.R.C., P.O. Box 2983, Joplin MO 64803.*

KNOXVILLE, TN VE Exams for upgrades only will be held at Pellissippi State Tech. Comm. College, Room B-129 (formerly STIK, Pellissippi Campus). Sponsored by West Carolina ARS. Contact *Ray Adams N4BAQ, (615) 688-7771,* or *Rich Slover ND4F, (615) 539-4821.*

MEMPHIS, TN The WCARS will sponsor VE Exams at Central Church, 6655 Winchester Rd., at 9 AM. Please call *Win Guin W2GLJ, (901) 754-4552,* or *Nita Wofford N4DON, (901) 363-4971* for details.

NEW ALBANY, IN WCARS/VE Exams will be held in Room 204 at Knob View Bldg., Indiana University South, Grant Line Rd., from 10 AM to 2 PM. Please contact *Dick Truax K8GVU, (812) 246-6377,* or *"Mac" McCrory NM9A, (812) 944-6661.*

SYLACAUGA, AL The Talladega RAC 2nd Annual Old Fashioned Hamfest will be held at B.B. Comer Memorial School from 8 AM-4 PM. VE Exams. Friday night Set-up 5 PM-8 PM. For details, call *Jim Green KD4BHH, (205) 245-7825.* Talk-in on 145.270.

APR 18

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, will hold a Flea Market from 9 AM-2 PM at Albany and Main Sts. Set-up at 7 AM. Talk-in on 146.52 and 449.725/444.725 - pl 2A (W1XM rptr.). For info call *(617) 253-3776.*

OMAHA, NE The Ak-Sar-Ben ARC, Inc., will hold their annual Auction at the Millard Social Hall, I-80 and Hwy. 50 at exit 440 (about 1/4 mile south of the interchange on Hwy. 50). Buyer and seller registration begins at 7:30 AM. The Auction starts at 9:30 AM. Talk-in on 146.34/.94 (W0EQU rptr.). Contact *Ken Noel AJ0A, (402) 592-2338 after 6 PM - PBBS: 145.01 AJ0A @ K0BOY.NE;* or *Todd LeMense N0PHF, (402) 397-7465 after 6 PM PBBS: 145.01 N0PHF @ K0BOY.NE.*

ROCKFORD, IL A Hamfest/Computer Show, sponsored by the Rockford ARA, will be held at Rockford Metro Centre from 8 AM-4 PM. VE Exams. Talk-in on 146.01/.61. For info, call *Joe N9HEZ, (815) 399-6995.*

SULLIVAN, IL The Moultrie Amateur Radio Klub (M.A.R.K.) will hold their 32nd annual Hamfest at the Moultrie County 4-H Fairgrounds on the Caldwell Rd., 5 miles east of Sullivan. VE Exams from 9 AM-12 Noon, by pre-registration only; contact *M.A.R.K., P.O. Box 91, Lovington IL 61937.* For Hamfest details, call *Dave Duggins N9MPM, (217) 234-3283.*

WAREHAM/BUZZARDS BAY, MA The Wareham ARC will hold a Hamfest from 10 AM-2 PM. Talk-in on 147.915/.315 rptr., 146.52 simplex. For a flyer, send SASE to *Barry Kennedy N1EZH, 24 Bungalow Ln., Buzzards Bay MA 02532.*

WEBSTER, MA A Hamfest will be held by the Northeastern Conn. ARA, at the Point Breeze Restaurant, starting at 9 AM. Talk-in on 147.825/.225, 146.52 simplex. Contact *Chuck Weimer WB1AOC, 3 Plainview Dr., Danielson CT 06239. Tel. (203) 774-1723.*

APR 23

KETTERING, OH The Southwest Ohio Chapter of the Quarter Century Wireless Assn. will hold its 1993 Annual Banquet the first evening of the Dayton Hamvention, at Neil's Heritage House, starting at 7:30. Reservations required. Gordon West WB6NOA will be the featured speaker. Contact *Robert L. Dingle, Treas, Chapter 9, 1117 Big Hill Rd., Kettering OH 45429-1201.*

APR 24

ASHEVILLE, NC WCARS/VEC Exams will be offered at the Health and Social Services Bldg., at 9 AM. Please call *Norman G. Harrill N4NH, (704) 253-1192,* for details.

DALTON, GA WCARS VE Exams will be held at 3 PM at the Unity Baptist Church, Burleson Rd. Please contact *Bert L. Coker N4BZI, (706) 259-5625,* or *Harold W. Jones N4OTC, (706) 673-2291.*

MAY 1

CEDARBURG, WI The Ozaukee RC will sponsor its 15th Annual Cedarburg Swapfest, 8 AM-1 PM, at the Circle-B Recreation Center, Hwy. 60 and County I (20 miles north of Milwaukee, west of Grafton). Set-up at 6:30 AM. VE Exams at 9 AM. Talk-in on 146.37/.97 and 146.52. Contact *ORC Swapfest Chairman, 11448 Laguna Dr., Mequon WI 53092. Tel. (414) 242-4995.*

FREDERICKSBURG, VA VE Exams will be held in the Rappahannock Library on May 1st. For details call *AC4SK, (703) 373-7076,* or *AC4MB, (703) 891-5581.*

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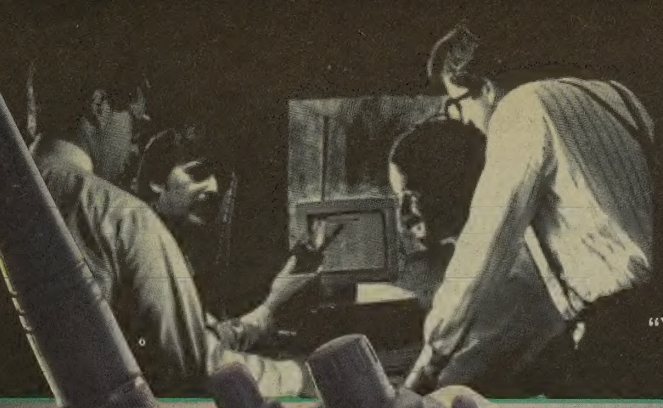
CSC-56	Vinyl Case w/ FNB-25
CSC-58	Vinyl Case w/ FNB-26/27
E-DC-5	12 VDC Adaptor
YH-2	Headset for VOX
MH-12A2B	Speaker Mic
MH-18A2B	Lapel Speaker Mic
MH-19A2B	Mini Earpiece Mic
MH-29A2B	LCD Display Mic with Remote Functions
MMB-54	Mobile Mounting Hanger



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